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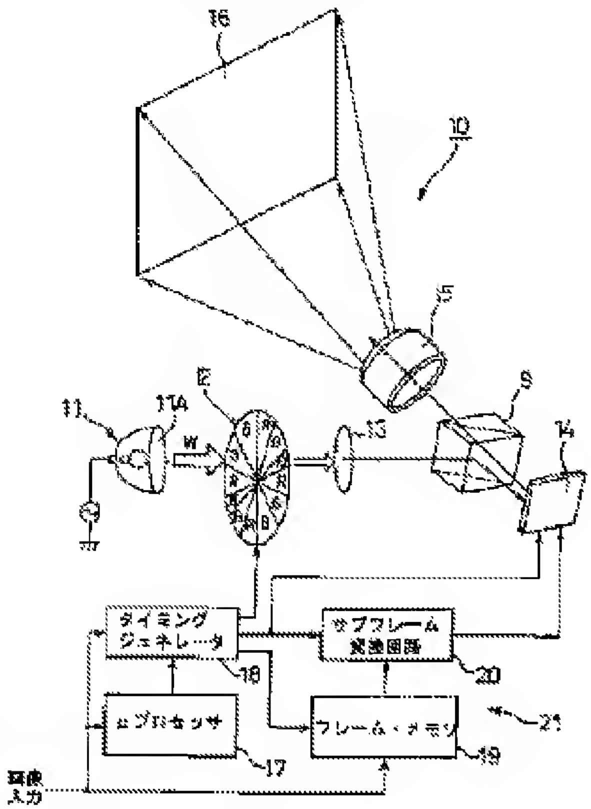
Abstract:
PROBLEM TO BE SOLVED: To provide the color image generating device of a feel sequential system which is capable of performing satisfactory assigning intensity levels in which luminance is not lowered. SOLUTION: A color image generating device 10 is constituted of a light source 11, a rotary color filter 12, a condensing lens 13, an electrooptical device 14 and a projection lens 15. The rotary color filter 12 is provided with plural color filters for each color so as to divide plural subframe periods during one

frame period by rotation. In the electroptical device 14, color image data are written in each pixel before a corresponding color subframe period in accordance with the weight of a gradation and the color image of a subframe is generated in synchronization with the corresponding color subframe period. Thus, since color images are selectively generated in color subframe periods in accordance with the weight of the gradation in this manner, satisfactory assigning intensity levels become possible.



JPO Machine translation abstract:

(57) **Abstract**

SUBJECT The color picture generating device of a Feer sequential system which can perform the good gradation display without brightness lowering is provided.

Means for Solution The color picture generating device 10 consists of the light source 11, the rotation light filter 12, the condenser 13, the electro-optic device 14, and the projector lens 15. The rotation light filter 12 is provided with two or more light filters in each color so that rotation may divide two or more color subframe periods at 1 frame period. In the electro-optic device 14, before a color subframe period corresponding according to a weighting of gradation, color image data is written in each pixel, and a color image of a subframe is generated synchronizing with a corresponding color subframe period. Thus, since a color subframe period is made to generate a color image selectively according to a weighting of gradation, a good gradation display is attained.

Claim(s)

Claim 1 Are a color picture generating device characterized by comprising the following, and a generation period of each of said colored light within 1 scan period, It is divided during **two or more** the division colored light generation, respectively, and said colored light generation part, Generate colored light for every division colored light generation period, and said image generation part, In a weighting period of gradation of pulse width modulation defined for every colored light within 1 scan period. A color picture generating device generating a picture which has the gradation of each colored light by

driving a pixel selectively based on picture information, and making said two or more division colored light generation periods and a weighting period of said gradation come to correspond.
A colored light generation part as for which time comes out one by one and which generates two or more colored light within 1 scan period, respectively.
An image generation part as for which time comes out one by one corresponding to said colored light generation part and which generates a color image for said every colored light.

Claim 2 The color picture generating device according to claim 1, wherein a group period when it locates at a time said one period of division colored light generation periods which generate said mutually different colored light by time amount sequential comes out one by one in time and are provided within 1 scan period. **two or more**
Claim 3 The color picture generating device according to claim 2, wherein an order of a color of said colored light generated within said group period is constant.
Claim 4 The color picture generating device according to claim 2, wherein an order of a color of said colored light generated within said group period is unfixed.
Claim 5 The color picture generating device according to any one of claims 1 to 4, wherein said division colored light generation period of said colored light of the same color is mutually set as an equal period.
Claim 6 The color picture generating device according to any one of claims 1 to 4, wherein said division colored light generation period of said colored light of the same color is set as a mutually different period.
Claim 7 The length of each time of said division colored light generation period of said plurality (n:2 or more integers) which constitutes a generation period of each of said colored light within 1 scan period, The color picture generating device according to claim 6 if quota time of colored light of each color generated within 1 frame period is set to CT and the number of maximum gradation is set to Hmax, wherein the following formula, CT and 2^{m}/Hmax, however m are one which satisfies an integer of less than or more 0n of length.
Claim 8 The color picture generating device according to any one of claims 1 to 7, wherein said colored light generation part is provided with a light source and a rotation light filter which generates said two or more colored light based on light from this light source.
Claim 9 The color picture generating device according to any one of claims 1 to 7, wherein said colored light generation part is provided with a light source which generates said two or more colored light, respectively, and these light sources change and are turned on by time amount sequential.
Claim 10 The color picture generating device according to any one of claims 1 to 9, wherein said image generation part is a reflection type electro-optic device.
Claim 11 The color picture generating device according to claim 10, wherein said electro-optic device is a liquid crystal device.
Claim 12 Said electro-optic device is provided with a substrate for electro-optic devices with which a picture element electrode was formed in a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode, respectively, and to said substrate for electro-optic devices. Pixel drive operation which reads a precedence color image digital signal stored temporarily, and carries out a pixel drive for said every pixel, Temporary storage operation to a lagging color image digital signal of the same pixel outputted to the next of said precedence color image digital signal at said signal electrode, A pixel circuit performed while shifting memory signals one by one in concurrency corresponds, respectively, and is made, and said precedence color image digital signal is color image data corresponding to the division colored light generation period concerned which reads and carries out a pixel drive synchronizing with said division colored light generation period.
The color picture generating device according to claim 10 or 11, wherein said lagging color image digital signal is a color image digital signal corresponding to a division colored light generation period located at the next of said division colored light

generation period.

Claim 13 The color picture generating device comprising according to claim 12:
The at least 1st and the 2nd sample hold means for said pixel circuit to carry out sample hold of the signal on said signal electrode by time amount sequential.
A pixel driving means for reading the 1st momentary holding signal held by said 1st sample hold means, and the 2nd momentary holding signal held by said 2nd sample hold means by time amount sequential, and performing a pixel drive to said picture element electrode according to the read signal.

Claim 14 The color picture generating device comprising according to claim 13:
Said 1st sample hold means is the 1st signal holding means.
The 1st signal code book lump means that opens and closes with the 1st write timing signal, and samples a signal on said signal electrode to said 1st signal holding means.
Having, said 2nd sample hold means is the 2nd signal holding means.
The 2nd signal code book lump means that opens and closes with the 2nd write timing signal, and samples a signal on said signal electrode to said 2nd signal holding means.

Claim 15 Said 1st writing means is the 1st transistor that other terminals electrically connect to said 1st signal holding means while one terminal electrically connects with said signal electrode, The color picture generating device according to claim 14, wherein said 2nd signal code book lump means is the 2nd transistor that one terminal electrically connects with said signal electrode, and other terminals electrically connect to said 2nd signal holding means.
Claim 16 Said electro-optic device is provided with a substrate for electro-optic devices with which a picture element electrode was formed in a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode, respectively, and to said substrate for electro-optic devices. For said every pixel. Shifting in concurrency static drive operation of a picture element electrode based on a precedence color image digital signal which carried out temporary storage maintenance, and temporary storage operation to a lagging color image digital signal of the same pixel that arrives at said signal electrode after fixed time from the precedence color image digital signal one by one. A digital memory measure to perform corresponds, respectively, and is made, and said precedence color image digital signal is a signal corresponding to a weighting of gradation corresponding to the division colored light generation period concerned read synchronizing with said division colored light generation period.
The color picture generating device according to claim 11, wherein said lagging color image digital signal is a signal corresponding to a weighting of gradation corresponding to a subframe period located at the next of said division colored light generation period.

Claim 17 Said electro-optic device is provided with a substrate for electro-optic devices with which a picture element electrode was formed in a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode, respectively, and said substrate for electro-optic devices, Temporary storage maintenance is carried out shifting digital data which arrives at said signal electrode to two or more storage cells which carried out cascade connection one by one for said every pixel, A digital memory measure which carries out the static drives of said picture element electrode based on a memory output of said storage cell of a final stage corresponds, respectively, is made, and a memory output of said storage cell of said final stage, The color picture generating device according to claim 11 being a color image digital signal read synchronizing with said division colored light generation period.
Claim 18 The 1st latch means that said digital memory measure incorporates said color image digital signal which arrives at said signal electrode, and is stored temporarily, The 2nd latch means that read a precedence color image digital signal memorized before one rather than said color image digital signal in this 1st latch means before data incorporation operation of said 1st latch means, and it is stored temporarily, and carries out the static drives of said picture element electrode based on the memory output, The

color picture generating device according to claim 17 having even if small.
Claim 19 The color picture generating device comprising according to claim 18:
The 1st data selection means from which said 1st latch means incorporates said color image digital signal.
Have the 1st flip-flop that stores temporarily a color image digital signal incorporated by this 1st data selection means, and said 2nd latch means, The 2nd flip-flop that stores temporarily a color image digital signal incorporated by the 2nd data selection means that incorporates output data of said 1st flip-flop, and this 2nd data selection means and by which the memory output is electrically connected to said picture element electrode.

Claim 20 Said 1st data selection means is 1st MOS transistor for data transfer conducted synchronizing with the 1st timing pulse, and said 1st flip-flop, Are the 1st synchronous method flip-flop that carries out storage operation synchronizing with said 1st timing pulse, and said 2nd data selection means, Are the 2nd MOS transistor for data transfer conducted synchronizing with the 2nd timing pulse produced before said 2nd timing pulse, and said 2nd flip-flop, The color picture generating device according to claim 19 being the 2nd synchronous method flip-flop that carries out storage operation synchronizing with said 2nd timing pulse.
Claim 21 Said 1st data selection means is 1st 1 input type gate element that carries out logic operation synchronizing with said 1st timing pulse.
Synchronizing with said 1st timing pulse, said 1st flip-flop is the 1st synchronous method flip-flop that carries out storage operation, and said 2nd data selection means, The color picture generating device according to claim 19, wherein it is 2nd 1 input type gate element that carries out logic operation synchronizing with said 2nd timing pulse and said 2nd flip-flop is the 2nd synchronous method flip-flop that carries out storage operation synchronizing with said 2nd timing pulse.

Claim 22 It is a drive method of a color picture generating device which makes two or more colored light generate by time amount sequential, glares to an image generation part, and performs image generation for every colored light by said image generation part by the time sequential corresponding to said two or more colored light, A generation period of each of said colored light within 1 scan period, It is divided during **two or more** the division colored light generation, respectively, generate colored light for every division colored light generation period, and said image generation part, In a weighting period of gradation of pulse width modulation defined for every colored light within 1 scan period. A drive method of a color picture generating device generating a picture which has the gradation of each colored light by driving a pixel selectively based on picture information, and making said two or more division colored light generation periods and a weighting period of said gradation correspond.
Claim 23A drive method of the color picture generating device according to claim 22, wherein said division colored light generation period of said colored light of the same color is an equal period mutually.
Claim 24A drive method of the color picture generating device according to claim 22, wherein said division colored light generation period of each of said colored light of the same color is a period of mutually different length.
Claim 25A drive method of the color picture generating device according to any one of claims 22 to 24, wherein said colored light generation part is provided with a rotation light filter as for which time carries out color separation of the light emitted from a light source one by one and which generates each of two or more of said colored light.
Claim 26A drive method of the color picture generating device according to any one of claims 22 to 24, wherein said colored light generation part is provided with a light source which generates two or more colored light, respectively, and these light sources change and are turned on by time amount sequential.
Claim 27A drive method of the color picture generating device according to any one of claims 22 to 26, wherein said image generation part is a reflection type electro-optic device.
Claim 28 An electronic device provided with the color picture generating device according

to any one of claims 1 to 21.

Detailed Description of the Invention
0001
Field of the Invention About the color picture generating device which drives this invention with a field sequential system, and performs color picture generation, a color picture generation method, and an electronic device, in more detail, It is related with an electronic device provided with the color picture generating device, color picture generation method, and color picture generating device of the digital drive which can perform a gradation display easily.
0002
Description of the Prior Art There are some which perform a colored presentation within a single dot as a color picture generating device with time lag mixed colors, i.e., the additive color mixing by a time-division-driving system. In such a color picture generating device, since 1 pixel turns into one picture element, there is an advantage that one 3 times the resolution of this is obtained as compared with the color picture generating device which performs juxtaposition mixed colors.
0003 As a color picture generating device of such a field sequential system, R which generated the light from a white light source through the rotation light filter (red), the colored light of G (green) and B (blue) -- time order -- next, it glares on an electro-optic device, and it displays with this electro-optic device, or there are some which make the colored light which was modulated with the electro-optic device, and was reflected or penetrated project on a screen, and display a color picture.
0004 In order to perform a gradation display with such a color picture generating device, There is what is called a Pulse-Density-Modulation drive system that divides 1 frame period (one vertical scanning period) during **two or more** the subframe, chooses a subframe period suitably within 1 frame period according to the gradation of a display image, and outputs an image generation signal. When setting up a subframe period in image generation, as shown in drawing 24, R of the rotation light filter 1, Each colored filter of G and B is equally divided into two, and two or more subframe periods are assigned within the period which has each colored filter 1R, 1G, 1B, 2R, and 2G and 2B in the position into which the white light irradiated from a light source enters. Namely, the period when the 1st red filter 1R is chosen as shown in drawing 25. (It is hereafter called a colored light generation period) It is a subframe period (1 SF) of four image generation in 1R. 2SF, 3SF, and 4SF are assigned, and the subframe period (5SF, 6SF, 7SF, 8SF) of four image generation is assigned within R light generation period 2R when the 2nd red filter 2R is chosen.
0005 And an electro-optic device generates the gradation of each colored light for every pixel by driving each pixel with the pulse width modulation which modulates colored light with the binary of ON and OFF, and changing the pulse width of ON and OFF according to picture information. For example, a pixel is driven and colored light is modulated for every pixel so that colored light may be penetrated or (in the case of a transmission type electro-optic device) reflected only during the ON (in the case of a reflection type electro-optic device). In the case of drawing 25, within eight subframe periods which exist in 1 frame period, it corresponds, respectively, eight weighting periods of the gradation in pulse width modulation are arranged, and the level of gradation is controlled by in any of eight subframe periods a pixel is set to ON. The same drive is performed also in the green filter or the blue filter.
0006 As the above-mentioned example and an example which assigned two or more subframe periods within one colored light generation period similarly, the sequential color imaging method concerning the JP,H8-51633,A description is known. Drawing 26 is a timing chart which shows the relation between the colored light generation (color subframe) period in this sequential color imaging method, and each color image generation signals.
0007

Problem to be solved by the invention However, in the color picture generating device of the above-mentioned field sequential system, two or more subframe periods are assigned by the image generation side within 1 colored-light generation period. Therefore, it is necessary to carry out the address of each pixel for every subframe period, and to impress the image data which decides whether to drive a pixel in the subframe period to each pixel. Since the addressing period of a pixel would be included for every subframe period, the more the pixel number increased, the addressing period occupied during the colored light generation became long, and, the more there was a problem that the period when a color image is generated substantially was short.
0008 In the scanning line selection period which chose the scanning line when transmission was started, for example in the division colored light generation period, the data signal of the 1st line pixel of the 1st row is refreshed -- having (rewritten) -- in the pixel of others of the 1st line, or the pixel of the 2nd less than line, the signal of the front subframe remains as it is. For this reason, in order that the modulation operation (display action) of the colored light in each pixel and the operation which writes image data in each pixel one by one may carry out synchronization within the 1 display period of a picture (inside of the vertical scanning period which displays one screen), The display portion by the image data written in the front subframe in the 1 display screen and the display portion by the image data written in in the present subframe are intermingled. therefore, the substitute of the beginning of the period when colored light was generated -- hurrah, in a period, all the image data for colored light in the front colored light generation period written in in the last frame period is the generation periods of the present colored light until it is rewritten -- being also alike -- it will not be involved but abnormal conditions will be made by the image data of front colored light. Also in the subframe period within a colored light generation period, although all the image data before being written in in the last subframe period is the subframe periods of ** until it is rewritten, abnormal conditions will be made by front image data. Thereby, the unevenness of mixed colors, or gradation degradation and a display screen arises.
0009 Since a write-in period can be shortened when pixel numbers are comparatively few display screens, Although vision is hard to be carried out, the part and all the pixel display periods when the write-in period of all the pixels becomes long become short, the unevenness of a display screen actualizes, and the unevenness of the above display screens causes deterioration of image quality, and the fall of luminosity, so that it increases a pixel number. Of course, in a signal line driving circuit, although not a point sequential drive system but a line sequential drive system is employable, Even in this case, since **of the picture corresponding to a front subframe, and the picture corresponding to a back subframe** it cut and replaced, the pixel advanced by line sequential and it has appeared on the display screen as it is, the unevenness of a display screen arises too. When a pixel number is increased, deterioration of image quality is further caused by the unevenness of a display screen. For this reason, big-screen-izing or highly-minute-izing by the number of high pixels had a limit. Since the period assigned during the weighting for substantial Pulse Density Modulation becomes short, pulse width for a gradation display cannot fully be secured, and good color picture generation cannot be performed.
0010 Then, the issue which this invention tends to solve is at the point what kind of means should be provided, in order to obtain the color picture generating device, color picture generation method, and electronic device which can perform the good gradation display without brightness lowering.
0011
Means for solving problem In order to solve above-mentioned SUBJECT, the means provided by this invention, The colored light generation part as for which time comes out one by one and which generates two or more colored light within 1 frame period, respectively, The image generation part which generates the color image for every colored light by time sequential corresponding to this colored light generation part, While it is a color picture generating device of a ******** field sequential system, and the generation period of each colored light divides during **two or more** the division colored light generation and is arranged within 1 frame period, The weighting period of the

gradation of the color image in an image generation part and the division colored light generation period corresponding to this color are abbreviated-in agreement, and an image generation part generates a color image selectively to a division colored light generation period according to the weighting of gradation.

0012 Since the division colored light generation period which divides the generation period of colored light, and the weighting period of the gradation of the color image in an image generation part are abbreviated-in agreement according to such composition of this invention, the color image in which it continued during the division colored light generation, and the weighting of the gradation was carried out is generable. For this reason, the ratio of the image generation period to a division colored light generation period is high, and luminosity of a display image can be made high. Since **on which a division colored light generation period spreads abbreviation etc. during the weighting of the gradation of a color image** it is set up, it has the effect that the gradation display of a color image can be performed efficiently.

0013 As for this invention, it is preferred that the group period when it locates at a time one period of division colored light generation periods which generate mutually different colored light by time amount sequential comes out one by one in time, and are provided within 1 frame period. **two or more** Since the division colored light generation period of a different color is arranged by time amount sequential according to such composition, it becomes possible to perform time lag additive color mixing of the color image generated good. if an order of the color of the colored light generated within this group period is fixed, it will set up in order of a repetition of colored light which does not perceive sense of incongruity to a generated image -- things can be carried out. On the contrary, when making unfixed an order of the color of the colored light generated within a group period, it becomes possible to avoid an order of the color of the colored light which is easy to be perceived.

0014 It is good also as composition which sets mutually the division colored light generation period of the colored light of the same color as an equal period in this invention. According to such composition, it is effective in control with the colored light generating timing of a colored light generation part and the color image generating timing of an image generation part becoming easy, and the composition of the subframe conversion circuit in an image generation part becoming easy.

0015 As for this invention, it is preferred that the division colored light generation period of the colored light of the same color is set as a mutually different period. According to such composition, it has the effect that many gradation numbers are realizable with the number of selections of a division colored light generation period with few each pixel within 1 frame period, by choosing the division colored light generation period according to the weighting of the gradation of a color image. The length of each time of the division colored light generation period of said plurality (n:2 or more integers) which constitutes the generation period of each colored light within 1 frame period specifically, When quota time of the colored light of each color generated within 1 frame period is set to CT and the number of maximum gradation is set to Hmax, it is preferred to set it as one which satisfies CT and 2^{m}/Hmax (however, m integer of less than or more 0n) of length. For example, if several n of a division colored light generation period is 8, the ratio of the length of eight division colored light generation periods, It is set to 1(=2^{0}):2(=2^{1}):4(=2^{2}):8(=2^{3}):16(=2^{4}):32(=2^{5}):64(=2^{6}):128 (=2^{7}), and the number Hmax of maximum gradation can be realized 256 times. Incidentally, drawing 23 shows the case where a pixel is driven using a pulse modulation (PWM) system. Drawing 23 (A) shows the data period defined by Vertical Synchronizing signal VSYN. The figure shows driving a pixel to an ON state by each pixel during **each** the colored light generation with the pulse width corresponding the colored light generation period in one scan period to gradation only by dividing into three. Drawing 23 (B) shows among (A) what kind of pulse width can be chosen as the generation period of R light about red light.When indicating each colored light by gradation by 4-bit image data, the pulse width of eight different length of 2^{0} - 2^{7} is generated by pulse width, and 256 gradation can be displayed by combining this pulse width. The example of a pulse of the 170th gradation in 256 gradation is shown in the figure. A pulse may be made to continue like the case where a pulse is distributed

like the 2nd from under a figure as timing which carries out a pulse width drive, and the lowest. It is made more desirable **for a pulse to continue** and a gap of the gradation depended for a pulse shape becoming blunt can be prevented. A pulse cannot be doubled with a front tip but can also be doubled with a trailing edge.

0016 In this invention, each of a period of pulse width of two or more kinds of this length that is followed to pulse width modulation and kicked is equivalent to "a weighting period in pulse width modulation" for expressing a gradation level of each pixel. And although a weighting period by each of this pulse width shifts a pulse and is positioned one by one within 1 frame period by drawing 23, In this invention, the above-mentioned weighting period is assigned for every division colored light generation period which makes a weighting period by this pulse width continue, does not generate, and is distributed and generated within 1 frame period for every colored light. Therefore, the number of division colored light generation periods for every colored light and the number of weighting periods of pulse width modulation (the number of kinds of pulse width) turn into the same number fundamentally. What is necessary is just to position a weighting period within the period, if the division colored light generation period is set up for a long time than equivalent although the length of a division colored light generation period and a weighting period may not correspond. Although a mutual weighting period may give a relation of the length of a multiple of 2, it is preferred to adjust the length of a period so that the nonlinear characteristic (it is called the gamma characteristic) of light transmittance (reflectance) of an electro-optic device may be compensated and gradation may become a linear change.

0017 It can have composition provided with a light source and the rotation light filter which generates two or more colored light based on the light from this light source as a colored light generation part in this invention. According to such composition of this invention, it has the effect that the drive and control by the side of a light source become very easy, by using light including the wavelength band region of two or more colored light. In this invention, in order for what is necessary just to be to rotate a rotation light filter with predetermined revolving speed, this also has the effect that the colored light where a drive and control became easy and was stabilized is generable.

0018 As a colored light generation part in this invention, it can have a light source which generates two or more colored light, respectively, and these light sources can have composition changed and turned on by time amount sequential. According to this invention of such composition, since two or more colored light is directly generable with a light source, it has an effect which raises the utilization efficiency of colored light.

0019 It is preferred to be able to use a reflection type electro-optic device and to use especially a liquid crystal device as an image generation part in this invention. According to this invention of such composition, a good gradation display can be performed, for example in the display device of a direct viewing type, and a projected type display device. A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device in this invention, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a liquid crystal device using the double reflex of liquid crystals, such as a liquid crystal device, OCB, ECB mode, etc. which the cell gap of the TN liquid crystal cell was set up narrowly, and a light scattering type liquid crystal using a polymer dispersed liquid crystal, are applicable. Micro mirror devices, such as a digital micro mirror device (DMD), are applicable as an electro-optic device. According to this invention, luminosity of the display image of the electro-optic device of field sequential systems including a liquid crystal device can be made high by leaps and bounds as compared with the former, and it has the effect that a bright color picture is generable.

0020 This invention is characterized by having a substrate for electro-optic devices of the following composition, in order to raise the luminosity of a color picture and to perform a gradation display good. The substrate for electro-optic devices which it has by this invention can be used as a substrate of digital drive type display devices, such as a liquid

crystal device, DMD, a field emission device, a plasma display, an electroluminescence device, and LED.

0021 Namely, as an electro-optic device applied to this invention, The pixel drive operation which reads the precedence color image digital signal which equipped the pixel corresponding to the matrix intersection of a scanning electrode and a signal electrode with the substrate for electro-optic devices with which the picture element electrode was formed, respectively, and was stored temporarily for every pixel at it, and carries out a pixel drive, The pixel circuit performed while shifting memory signals one by one in concurrency corresponds, respectively, and is made, and the temporary storage operation to the lagging color image digital signal of the same pixel outputted to a signal electrode after a precedence color image digital signal. It is arranged by the transparent base which counters this substrate for electro-optic devices, and pinches electrooptic material and which has a counterelectrode, and said precedence color image digital signal, It is color image data corresponding to the division colored light generation period concerned which reads and carries out a pixel drive synchronizing with said division colored light generation period, and is considering as composition that a lagging color image digital signal is a color image digital signal corresponding to the division colored light generation period located at the next of the division colored light generation period.

0022 Although timing which stores a signal of the same pixel temporarily at retention volume, and timing which carries out the pixel drive of the electrooptic material are in agreement in the conventional pixel circuit, Timing which stores a signal from a signal electrode temporarily according to the color picture generating device of this invention, Since timing which reads the temporary storage signal and drives a pixel can be positively shifted within fixed time (for example, division colored light generation period), it continues during the next division colored light generation, and a simultaneous drive (simultaneous stillness display) of all the pixels can be realized.

0023 In this invention, since writing only stops at temporary storage sequential irrespective of a dot sequential system or a line sequential color TV system, it does not actualize as pixel drive sequential, but write-in sequential one can perform a frame (subframe) change display simultaneous in all the pixels. Thereby, unevenness of a display screen can be canceled and a high-definition color picture generating device can be provided. For this reason, it is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized. It continues during the division colored light generation, a simultaneous drive (simultaneous stillness display) of all the pixels can also be realized, and display time and a write time do not conflict, but substantial display time can be lengthened as compared with a color picture generating device of the conventional field sequential system. For this reason, much more high definition-ization can be attained in this invention. It continues during the color subfield, temporary storage operation of all the pixels can also be realized, and a write period can be lengthened. Therefore, it becomes possible to attain low speed-ization of a signal transfer rate, and simplification and formation of a high pixel number of peripheral circuit composition can be realized. It has the effect that frame memories for indicative datas which carry out external to a substrate for electro-optic devices are reducible etc.

0024 As such a pixel drive delayed type pixel circuit, The temporary storage operation which incorporates the color image digital signal from a signal electrode Two or more sample hold means exclusive at time sharing which it is, and are carried out and are performed on a target one by one, The momentary holding signal from each sample hold means is read, and it has an exclusive pixel driving means which it is, and is carried out and is performed on a target one by one for pixel drive operation by time sharing. Generally, it is enough if constituted only from the 1st and the 2nd sample hold means as a sample hold means. In this case, it becomes the same **the pixel driving period of a precedence color image digital signal** as the write period of a lagging color image digital signal.

0025 In this invention, a more than **3rd** sample hold means may be established. Since the write period of a lagging color image digital signal can also be made into twice (N-1) the pixel driving period of a precedence color image digital signal, for example when it has N sample hold means, A signal transfer rate can be low-speed-ized further, and the

simplification and the formation of a high pixel number of peripheral circuit composition will become remarkable. If two sample hold means are established like this invention, for example in the case of a field sequential system, G color subframe signal (G color image digital signal) can be written in R division colored light generation period. B color subframe signal (B color image digital signal) can be written in G division colored light generation period. R color subframe signal (R color image digital signal) can be written in B division colored light generation period. Thus, although what is necessary is just composition provided with two sample hold means in a field sequential system, it is good also as composition which establishes three sample hold means, for example. According to such composition, it can continue R division colored light generation period and during the G division colored light generation, and B frame signal (B color image digital signal) can be written in. It can continue G division colored light generation period and during the B division colored light generation, and R color subframe signal (R color image digital signal) can be written in. Similarly, it can continue B division colored light generation period and during the R division colored light generation, and G color subframe signal (G color image digital signal) can be written in.

0026in this sample hold means, one signal electrode a quota ******** case to each pixel, After serial parallel conversion of the serial signal on one signal electrode is distributed and carried out to a precedence color image digital signal and a lagging color image digital signal in two or more sample hold means, it stores temporarily, respectively. In this case, the number of the scanning electrode for controlling the selection timing of two or more sample hold means is **number of sample hold means** needed. For example, when it provides the 1st and the 2nd sample hold means, one signal electrode and two scanning electrodes are needed. On the contrary, when providing the signal electrode only for an odd frame, and the signal electrode only for even frames, for example, one scanning electrode can be shared, and the 1st and the 2nd sample hold means do not perform the function as a serial-parallel-conversion means any longer, but only a temporary storage function is achieved.

0027 In this invention, as the 1st above-mentioned sample hold means, the 1st signal holding means, The 1st signal code book lump means that opens and closes with the 1st write timing signal, and samples the signal (color image digital signal) on a signal electrode to the 1st signal holding means, It **** and has the 2nd signal holding means and the 2nd signal code book lump means that opens and closes with the 2nd write timing signal, and samples the signal (color image digital signal) on said signal electrode to said 2nd signal holding means as said 2nd sample hold means. The precedence color image digital signal corresponding to the division colored light generation period of precedence, For example, while being held by the 1st signal code book lump means temporarily at the 1st means holding mechanism, the lagging color image digital signal corresponding to the division colored light generation period of lagging is held by the 2nd signal code book lump means temporarily at the 2nd signal holding means.

0028 The 1st signal code book lump means is specifically used as the 1st transistor that one terminal electrically connects with a signal electrode, and other terminals electrically connect to the 1st signal holding means, One terminal electrically connects with a signal electrode, and the 2nd signal code book lump means can be used as the 2nd transistor that other terminals electrically connect to the 2nd signal code book lump means. Here, the transistor can use not only a mono- Poral but a bipolar transistor.

0029 This invention is characterized by having a substrate for electro-optic devices of the following composition, in order to raise luminosity of a color picture and to perform a gradation display good. A substrate for electro-optic devices which it has by this invention can be used as a substrate of digital drive type display devices, such as a liquid crystal device, DMD, a field emission device, a plasma display, an electroluminescence device, and LED.

0030 Namely, this invention is provided with a substrate for electro-optic devices with which a picture element electrode was formed in a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode, respectively, For said every pixel. Shifting in concurrency static drive operation of a picture element electrode based on a precedence color image digital signal which carried out temporary storage

maintenance, and temporary storage operation to a lagging color image digital signal of the same pixel that arrives at said signal electrode after fixed time from the precedence color image digital signal one by one. A digital memory measure to perform corresponds, respectively, and is made, and. A transparent base which counters this substrate for electro-optic devices, and pinches electrooptic material and which has a counterelectrode is arranged, A precedence color image digital signal is a signal corresponding to a weighting of gradation corresponding to the division colored light generation period concerned read synchronizing with a corresponding division colored light generation period, It considers as composition that a lagging color image digital signal is a signal corresponding to a weighting of gradation corresponding to a subframe period located at the next of a division colored light generation period to precede.
0031 The timing which stores temporarily the color image digital data from a signal electrode according to this invention of such composition, In order to carry out the phase shift of the timing which reads the temporary storage data and drives a pixel positively until all the picture element data is accumulated, After writing in and storing the data of all the pixels in a precedence division colored light generation period, the simultaneous display (stillness display) of all the pixels is realizable in the next division colored light generation period. In this invention, irrespective of write-in sequential one, such as a dot sequential system or a line sequential color TV system, write-in sequential one can stop by temporary storage sequential, and display simultaneity of a frame change display simultaneous in all the pixels and all the pixels can be realized by pixel drive (data read). Thereby, irrespective of some of pixel numbers of a color picture element generating device, the unevenness of a display screen can be canceled and big-screen-izing or highly minute-ization can be attained by high definition. The merits and demerits of display time and writing time do not conflict in 1 division colored light generation period, but display time can be lengthened about all the pixels as compared with the color picture generating device of the conventional field sequential system. For this reason, in this invention, it has an effect which makes high definition the display image of a color picture generating device. In this invention, since it continues during the division colored light generation and writing operation of all the pixels can be performed, writing time is securable for a long time. In this invention, since low speed-ization of a signal transfer rate can be expected in connection with the ability to lengthen writing time in this way, it has the effect that the simplification or the formation of a high pixel number of peripheral circuit composition is realizable. And there is an advantage that the frame memories for indicative datas which carry out external to the substrate of the electro-optic device which constitutes an image generation part are reducible. In particular, in this invention of such composition, since the pixel drive systems are not an active drive but the static drives based on temporary storage data, there is no attenuation of a pixel driving signal and a perfect digital drive is attained. For this reason, in this invention, the weighting period of the gradation of the color image in the electro-optic device as an image generation part and a division colored light generation period are abbreviated-coincided, And by choosing a division colored light generation period according to the weighting of gradation, and outputting a color image digital signal, it has the effect that it is stabilized and the so-called gradation control of pulse width modulation can be performed.
0032 In this invention, it has the substrate for electro-optic devices with which the picture element electrode was formed in the pixel corresponding to the matrix intersection of a scanning electrode and a signal electrode, respectively, Temporary storage maintenance is carried out shifting the color image digital data which arrives at a signal electrode to two or more storage cells which carried out cascade connection one by one for every pixel, The digital memory measure which carries out the static drives of said picture element electrode based on the memory output of said storage cell of a final stage corresponds, respectively, and is made, and the memory output of said storage cell of a final stage, It is preferred to consider it as the color image digital signal corresponding to the subframe period concerned read synchronizing with a division colored light generation period.
0033 According to this invention of such composition, since the storage cell of a final stage always bears, the storage cell which carries out the static drives of the picture

element electrode can perform a perfect digital drive. In order to perform color picture generation of a field sequential system, if a storage cell is constituted from two steps, even if it takes into consideration the period of temporary storage operation, and the period of memory output operation, it is enough in time, but three or more steps of storage cells may be provided.

0034 The 1st latch means that incorporates and stores temporarily the color image digital signal which arrives at a signal electrode as the above-mentioned digital memory measure in this invention, The 2nd latch means that read the precedence color image digital signal memorized before one rather than that color image digital signal in this 1st latch means before data incorporation operation of the 1st latch means, and it is stored temporarily, and carries out the static drives of the picture element electrode based on that memory output, Even if small, it is preferred to have composition which it has. Here, the 2nd latch means has the feature in the place which carries out static drives, and the 1st latch means has the feature in the place which functions as a data delay means.

0035 And the 1st data selection means from which the 1st latch means incorporates a color image digital signal, Have the 1st flip-flop that stores temporarily the color image digital signal incorporated by the 1st data selection means, and the 2nd latch means, The color image digital signal incorporated by the 2nd data selection means that incorporates the output data of the 1st flip-flop, and the 2nd data selection means is stored temporarily, and it has the 2nd flip-flop by which the memory output is electrically connected to said picture element electrode. The 1st flip-flop functions as a delay means, and the 2nd flip-flop functions as a static driving means of a picture element electrode.

0036 As the 1st above-mentioned data selection means, various kinds of composition is employable. For example, the 1st data selection means is 1st MOS transistor for data transfer conducted synchronizing with the 1st timing pulse, The 1st flip-flop is the 1st synchronous method flip-flop that carries out storage operation synchronizing with the 1st timing pulse, The 2nd data selection means is 2nd MOS transistor for data transfer conducted synchronizing with the 2nd timing pulse produced before the 2nd timing pulse, The 2nd flip-flop can be used as the 2nd synchronous method flip-flop that carries out storage operation synchronizing with the 2nd timing pulse. Thus, since a data selection means can be constituted from one transistor, an element number is reducible.

0037 The 1st data selection means is 1st 1 input type gate element that carries out logic operation synchronizing with the 1st timing pulse, The 1st flip-flop is the 1st synchronous method flip-flop that carries out storage operation synchronizing with said 1st timing pulse, The 2nd data selection means is 2nd 1 input type gate element that carries out logic operation synchronizing with the 2nd timing pulse, and the 2nd flip-flop can be used as the 2nd synchronous method flip-flop that carries out storage operation synchronizing with said 2nd timing pulse. When 1 input type gate element is used as a data selection means, two or more transistors are needed, but it is effective in reduction of power consumption, waveform shaping, and energy amplification, and can function as a write-in driving means, and storage operation can be performed certainly. As this 1 input type gate element, a clocked inverter or 3 State buffer may be used, for example.

0038 In the color picture generation method concerning this invention, the good gradation display without brightness lowering can carry out. The means provided by this invention makes time amount sequential generate two or more colored light by a colored light generation part, and it irradiates with it to an image generation part, It is a drive method of the color picture generating device which performs image generation for every colored light by the time sequential corresponding to two or more colored light by an image generation part, Each colored light generation period of two or more colored light within 1 frame period is mutually divided during **two or more** the division colored light generation, and it is an image generation part, and adapted to generate selectively the color image corresponding to a division colored light generation period according to the weighting of gradation.

0039 Since the division colored light generation period which divides the generation period of colored light, and the weighting period of the gradation of the color image in an image generation part are abbreviated-in agreement according to such composition of this invention, the color image in which it continued during the division colored light

generation, and the weighting of the gradation was carried out is generable. For this reason, the ratio of the image generation period to a division colored light generation period is high, and luminosity of a display image can be made high. Since **on which a division colored light generation period spreads abbreviation etc. during the weighting of the gradation of a color image** it is set up, it has the effect that the gradation display of a color image can be performed efficiently.

0040 And said division colored light generation period of said colored light of the same color, If it is mutually set as an equal period, according to such composition, it is effective in control with the colored light generating timing of a colored light generation part and the color image generating timing of an image generation part becoming easy, and the composition of the subframe conversion circuit in an image generation part becoming easy.

0041 As for this invention, it is preferred that the division colored light generation period of the colored light of the same color is set as a mutually different period. According to such composition, it has the effect that many gradation numbers are realizable with the number of selections of a division colored light generation period with few each pixel within 1 frame period, by choosing the division colored light generation period according to the weighting of the gradation of a color image.

0042 It is using the light which includes the wavelength band region of two or more colored light by having composition provided with the rotation light filter in which a colored light generation part's carries out color separation of the light emitted from a light source one by one in time, and generates each of two or more of said colored light in this method, It has the effect that the drive and control by the side of a light source become very easy. In this invention, in order for what is necessary just to be to rotate a rotation light filter with predetermined revolving speed, this also has the effect that the colored light where a drive and control became easy and was stabilized is generable.

0043 In the method concerning this invention, a colored light generation part can be provided with the light source which generates two or more colored light, respectively, and it can have composition which these light sources change and by which they are turned on by time amount sequential. Since two or more colored light is directly generable with a light source if it has such composition, it has an effect which raises the utilization efficiency of colored light.

0044 In the method concerning this invention, a reflection type and a transmission type electro-optic device can be used as an image generation part. As an electro-optic device, it is preferred to use a liquid crystal device. According to this invention of such composition, a good gradation display can be performed, for example in the display device of a direct viewing type, and a projected type display device. A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device in this invention, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a liquid crystal device using the double reflex of liquid crystals, such as a liquid crystal device, OCB, ECB mode, etc. which the cell gap of the TN liquid crystal cell was set up narrowly, and a light scattering type liquid crystal using a polymer dispersed liquid crystal, are applicable. Micro mirror devices, such as a digital micro mirror device (DMD), are applicable as an electro-optic device.

0045 According to this invention of such composition, luminosity of the display image of the electro-optic device of field sequential systems including a liquid crystal device can be made high by leaps and bounds as compared with the former, and it has the effect that a bright color picture is generable.

0046 Since a good gradation display can be performed with high-intensity if the above-mentioned color picture generating device is used for an electronic device, an electronic device provided with a high definition display is realizable.

0047

Mode for carrying out the invention The details of the electronic device hereafter provided with the color picture generating device, color picture generation method, and

color picture generating device concerning this invention are explained based on the embodiment shown in Drawings.

0048(Embodiment 1) Drawing 1 shows Embodiment 1 of the color picture generating device of the field sequential system concerning this invention by which a digital drive is carried out, and the color picture generation method. As shown in the figure, the color picture generating device 10 of this Embodiment 1, When it is arranged ahead of the light source 11 which emits red light, blue glow, and white light including each spectrum of green light, and this light source 11 and the field of red and a blue and green color element rotates, The rotation light filter 12 in which the light from a light source irradiates with the field of each color element, and the colored light based on the color element is generated one by one, The condenser 13 arranged ahead of this rotation light filter 12, The reflection type electro-optic device 14 as an image generation part which generates the color image corresponding to the color of the colored light which enters via the polarization beam splitter 9, and the condenser 13 and the polarization beam splitter 9, It is the projection type display provided with the projector lens 15 which projects in response to the light reflected and modulated with the electro-optic device 14, it is projected so that the colored light which received the abnormal conditions by image generation from the projector lens 15 may be overlapped on the screen 16 one by one, and the composite display of the color picture is carried out on the screen 16. The light source 11 is equipped with the reflector 11A which reflects illuminant light as shown in the figure.

0049 Since a polarization selective reflection film is formed along a lamination side of two triangular prisms as for the polarization beam splitter 9, When a light component **on the other hand / (for example, S polarization)** of S polarization which abbreviated-intersects perpendicularly mutually among entering colored light, and P polarization is reflected and it is reflected with the electro-optic device 14, a rotation degree of a polarization axis is controlled by a liquid crystal for every pixel. This reflected light penetrates the polarization beam splitter 9 again, and enters into the projector lens 15, and a polarization component (for example, P polarization component) of another side penetrates the polarization beam splitter 9, and enters into the projector lens 15. At this time, one polarization component (for example, S polarization component) returns to the light source side. Abnormal conditions are made when the electro-optic device 14 is a liquid crystal light valve, and light intensity which enters into the projector lens 15 changes according to a grade of rotation of a polarization axis. Since light from a light source is random polarization, so that most illuminant light may enter into the electro-optic device 14 via a polarization beam splitter, It is preferred to change into one polarization component (for example, S polarization component) a polarization component (for example, P polarization component) of another side included in illuminant light, and to form a polarization converter which arranges illuminant light with one polarization component between a light source and the polarization beam splitter 9.

0050 The rotation light filter 12 rotates so that multiple-times generation of each colored light may be carried out within 1 frame period (a display period of one screen = one vertical scanning period). Even if a rotation in 1 frame period is less than one rotation, as long as it can perform colored light generation of prescribed frequency, less than one revolution may be sufficient, but in this example, it shall rotate one time at 1 frame period. But one or more revolutions may be carried out to 1 frame period, and colored light generation of prescribed frequency may be carried out. Anyway, by the rotation, within 1 frame period, the rotation light filter 12 which constitutes a colored light generation part generates two or more colored light, and defines a colored light generation period. A colored light generation period of each colored light is divided within 1 frame period, respectively, and has a division colored light generation period for every colored light. In this invention, this division colored light generation period is called color subframe period.

0051such a color picture generating device 10 is mainly provided with the microprocessor 17, the timing generator 18, the frame memory 19, the subframe conversion circuit 20, and the drive circuit 21 come out of and constituted. With the timing generator 18, color image generation (drive) timing is synchronized with the color

subframe period set up by rotation of the rotation light filter 12 with the reflection type electro-optic device 14, and it controls by this color picture generating device 10.

0052 Next, the outline of operation of this Embodiment 1 is explained. First, it is made to sample in the sampling circuit which does not illustrate image data. And the synchronized signal in an image input signal is sent to the microprocessor 17 and the timing generator 18. Simultaneously with it, the image data in image data is written in the frame memory 19 to the timing controlled by the timing generator 18. The white light emitted from the light source 11 penetrates the rotation light filter 12 of three colors which rotates with the timing generator 18 synchronizing with the driving timing of the electro-optic device 14. Red light, blue glow, and green light are generated one by one from illuminant light by this, and the reflection type electro-optic device 14 glares via the condenser 13 by it. Light modulation is given by the electro-optic device 14, enlargement projection of each colored light irradiated in this way is carried out with the projector lens 15, and image formation is carried out to the screen 16, and it performs a color image display.

0053 The rotation light filter 12 used with the color picture generating device 10 of this Embodiment 1, As shown in drawing 2, it is arranged so that four each of the light filter 12R for red of the sector form where the circle was divided into 12, the light filter 12G for green, and the light filter 12B for blue may repeat the order of R, G, and B, and comes to be provided in one. In this rotation light filter 12, the light filters 12R, 12G, and 12B of R, G, and B constitute a group in the angle of 90 degrees, and four group (12R1, 12G1, 12B1) - (12R4, 12G4, 12 B4) is arranged on the whole. And in this Embodiment 1, it has set up so that the period which this rotation light filter 12 rotates one time may become the same as that of 1 frame period (1F) of the picture generated with the electro-optic device 14. That is, it is set up rotate one time at 1 frame period (1F). Number of rotations **as opposed to / as stated previously / 1 frame period (1F) of such a rotation light filter 12** , According to the number of the gradation levels and color subframe periods (sf) which are demanded, it is set up suitably, and is not limited to what rotates 1 frame-period (1F) per 1 like this Embodiment 1.

0054 When rotating the rotation light filter 12 one time in this Embodiment 1 at 1 frame period (1F), Time for the light from the light source 11 shown in drawing 1 to penetrate one of each of the light filter 12R (1-4), 12G (1-4), and 12B (1-4) which constitutes the rotation light filter 12 turns into a color subframe period (sf). According to this embodiment, each color element of the light filter has made the field width with an angle of 30 degrees which divided 90 degrees the 3rd grade, and since rotational speed is constant, each color subframe period (sf) is a period of the same length. The light of the predetermined wavelength band which the light filter was penetrated during this color subframe period (sf), and absorption and separation were carried out and was generated enters into the image generation field of the electro-optic device 14.

0055 Thus, when n group has a group of the light filter of R, G, and B within 1 frame period (1F), As shown in drawing 3, corresponding to the color subframe period (sf) of each color set up by rotation of the rotation light filter 12, image generation of each color is performed to n times (this Embodiment 1 4 times). In the inside RSF (1-n), GSF (1-n), and BSF of the said figure (1-n), the period in which the drive of a pixel is made according to the image data of each colored light currently written in each pixel during the corresponding color subframe is shown for every colored light. Each pixel of the electro-optic device 14 drives each pixel to an ON state or an OFF state with the pulse width modulation which modulates colored light with the binary of ON and OFF. The gradation of each colored light is generated for every pixel by changing the pulse width of ON and OFF according to image data (picture information). For example, a pixel is driven so that colored light may be penetrated or (in the case of a transmission type electro-optic device) reflected only during the ON (in the case of a reflection type electro-optic device), and according to the length of ON period, colored light is modulated for every pixel.

0056 That is, if it is red light, n pieces' pulse width (time width of ON) of mutually different time length who becomes a weighting period of gradation in a pulse width gradation system was made to correspond to each period of RSF1 - RSFn, and is distributed and positioned. For example, make the longest pulse width correspond to

RSF1, and a period which drives a pixel to the longest time ON state within a period of RSF1 is provided, Long pulse width is made to correspond to the second RSF2, a period which drives long time for a pixel to an ON state within a period of RSF2 the second is provided, and even pulse width of n pieces and RSFn(s) are similarly assigned to the couple 1. However, even from pulse width short even from long pulse width, even when an order to which pulse width is made to correspond is random, it is not cared about, but one by one, becomes long or tends to perform control by which assigning so that it may become short writes image data in a pixel. Similarly also in other colored light, GSF (1-n) and BSF (1-n) are received, n pieces' pulse width (time width of ON) of mutually different time length who becomes a weighting period of gradation in pulse width modulation is assigned, and a pixel is driven to an ON state by different time length in each color subframe period.

0057 Thus, during **each** the color subframe (sf). Synchronizing with this, one color image data of ON or OFF beforehand written in according to a weighting of gradation is read in all the pixels in the electro-optic device 14, During **which was assigned during / that / the subframe when each pixel was ON data according to that image data** the weighting, if it is a drive and off-data about a pixel, suppose un-driving that pixel during this subframe period. By this, if n color subframe periods pass, in which color subframe period, by whether it drove based on ON data to a pixel. With combination (the number of combination of 2^{n}) of pulse width of n pieces from which a weighting period of gradation differs. ON driving period of a pixel in an one-frame term period is decided, gradation (2^{n} either of the gradation) of each pixel is formed by that cause, and a picture is generated by all the pixels a drive and by un-driving in each subframe period in this. Since there are the four light filters 12R, 12G, and 12B of each color in this embodiment, respectively as shown in drawing 2, The color picture which a weighting period of gradation about each colored light becomes four kinds of pulse width, can express 2^{4}=16 gradation about each colored light, and is formed of three colors can perform a gradation display of 4096 colors.

0058in addition -- preceding with the color subframe period (sf) the color image data read in a corresponding color subframe period (sf) -- a dot order -- by the next or line sequential, it is alike and is written in all the pixels. However, the writing of image data may be performed to all the pixels for every color subframe, and rewriting of image data may carry out only to a required pixel at each color subframe. The image data needed in each subframe, Since it is a binary of whether a pixel is driven to an ON state in the subframe (ON), or to use an OFF state with a drive (OFF) and rewriting is unnecessary when a front subframe and data do not differ from each other, such control may be performed.

0059 The electro-optic device 14 used by this Embodiment 1, A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device of a liquid crystal light valve, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a light scattering type liquid crystal using the liquid crystal device using the double reflex of liquid crystals, such as the liquid crystal device and OCB which set up the cell gap of the TN liquid crystal cell narrowly, and ECB mode, a polymer dispersed liquid crystal, etc., are applicable. As an electro-optic device which is not a liquid crystal device, a micro mirror device like DMD which Texas Instruments developed is applicable.

0060 The case of the light scattering type liquid crystal equipment using a polymer dispersed liquid crystal etc., and in the case of a micro mirror device, The polarization beam splitter 9 is unnecessary, and in the case of the former, incident light is modulated by a reflection (in a transmission type, it penetrates), and light scattering, it indicates by gradation, and the latter indicates by gradation by whether it reflects in the projector lens 15, or an absorber is made to absorb by controlling the degree of angle of reflection of the mirror which reflects incident light for every pixel. However, in this case, the incident light and reflected light to an electro-optic device are a relation of a slanting reflection in oblique incidence, and an illumination system and a projection optical

system are arranged.
0061 The composition at the time of using a liquid crystal panel as the electro-optic device 14 is explained below. Drawing 14 is a figure showing the section of a liquid crystal panel. As shown in the figure, this electro-optic device 14, For example, the substrate 23 for panels (substrate for electro-optic devices) which adhered with adhesives on the supporting board 22 which consists of glass, ceramics, etc., It has the opposite transparent base 25 by which set the predetermined interval to the substrate 23 for panels, and the placed opposite was carried out to it via the sealant 24 arranged so that the picture element region (viewing area) on this substrate 23 for panels may be surrounded in frame form, It comes to enclose the liquid crystal 26 with the void by which form was carried out by the sealant 24 between the substrate 23 for panels, and the opposite transparent base 25. As described above, as the liquid crystal 26 Well-known TN (TwistedNematic) type liquid crystal, The perpendicular orientation type liquid crystal in which a liquid crystal element carries out abbreviated perpendicular orientation in the state of impressing no voltage, the level orientation type liquid crystal which carries out approximately level orientation without twisting a liquid crystal element in the state of impressing no voltage, and liquid crystals, such as a polymer dispersed liquid crystal, can be used.
0062 The counterelectrode (common electrode) 27 which consists of transparent conductive materials, such as ITO (indium tin oxide), for example is continued and formed in an opposite inner side side of the opposite transparent base 25 at least at the whole at a viewing area. On the other hand, it arranges and comes to form the picture element electrode 28 at the surface side which an active matrix circuit and various drive circuits which carry out the postscript of the substrate 23 for panels to a single crystal silicon substrate are made, and counters with said opposite transparent base 25 at matrix form. The picture element electrode 28 is good also as composition which arranges a reflective mirror for the electrode itself to the substrate side separately as a light transmittance state electrode, although the electrode itself is a reflector formed with an electrical conducting material which has light reflex nature. And in each picture element part, it has a means (sample hold circuit) which can store color image data corresponding to the color subframe period sf as a digital value (H level, L level) so that it may mention later. As shown in drawing 4, the light shielding film 29 which covers unnecessary light incidence is formed in a picture element region (viewing area) periphery of the substrate 23 for panels. While the terminal pad 30 is arranged and formed, the end side of the flexible tape wiring 32 is connected to this terminal pad 30 via the anisotropic conductive adhesives 31 at a periphery of the outside of the sealant 24 in the substrate 23 for panels. The other end side of this flexible tape wiring 32 is connected to the above-mentioned timing generator 18, the frame memory 19, the subframe conversion circuit 20, etc.
0063 In such an electro-optic device 14, by changing the effective voltage impressed to the liquid crystal 26 according to image data from the picture element electrode 28, according to change of the arrangement of the liquid crystal element in the liquid crystal 26, the plane of polarization and degree of dispersion of incident light are changed, and it is reflected and emitted. When changing a plane of polarization, incident light is entered via a polarizing element, a reflected light is led to the projector lens 15 via a polarizing element, and light intensity is modulated for every pixel. In change (in the cases **A liquid crystal.** of polymer distributed type etc.) of light scattering, light intensity is modulated for every pixel by providing a slit before the projector lens 15 and passing this.
0064 Next, an operation and operation of each element in the above-mentioned composition are explained. For example, before the timing to which the light from the light source 11 penetrates the red spectrum region (for example, light filter 12R1) of the rotation light filter 12, According to the read timing signal supplied from the timing generator 18, from the frame memory 19, the color image data of the red ingredient made to memorize beforehand in the driving period before this is read one by one, and is outputted to the subframe conversion circuit 20. The subframe conversion circuit 20 which received the color image data of this red ingredient, According to the gradation

level of the color image data of a red ingredient, the weighting period (two or more kinds of pulse width which shows the period which drives a pixel to an ON state) of gradation is set up, Two or more color subframe periods sf arranged within the 1 frame period 1F, a weighting period is made to correspond to the couple 1, and a period is passed -- a **** synchronization being carried out, and, **make and** Prior to a corresponding color subframe period, a color image digital signal (signal of the binary of whether to drive a pixel to an ON state during the pulse width of the weighting of the gradation which was able to be formed during **the** the subframe) is supplied to the electro-optic device 14 side to predetermined timing. . In the electro-optic device 14 side, are outputted from the subframe conversion circuit 20. The precedence writing of the color image digital signal with which relating with a color subframe period was performed according to the weighting of gradation is performed, The light from the light source 11 reads data to the timing which penetrates the red spectrum region (light filter 12R1) of the rotation light filter 12, It continues in the whole period (R color subframe period 1sf) when red light is generated with the rotation light filter 12 (12R1), and all the pixels are driven to an ON state or an OFF state. Timing control of the timing generator 18 is carried out so that the timing of each component may be synchronized in response to control of the microprocessor 17. In the electro-optic device 14, the liquid crystal 26 is driven for every pixel, red light is modulated and reflected, and the picture of red light is generated in connection with this. Therefore, the red light by which light intensity was modulated for every pixel (the light intensity of each pixel is determined via a polarizing element when a liquid crystal panel is used) enters into the projector lens 15, and the projection display of the picture of red light is carried out to the screen 16. And the picture of such red light is generated for every color subframe period sf set up correspond by the weighting of gradation within 1 frame period, and the projection display for 1 frame period of a color image is performed. During the color subframe of other colors **one frame of the picture of this red light is generated** of a between, other color images set up corresponding to the weighting of gradation are generated.

0065 Namely, to the timing which illuminant light penetrates, the green regions (12G1) of the rotation light filter 12. Like the case of red light, the image data for green light is read from the frame memory 19, and a predetermined color subframe period (sf) and the color image data in which relating was given are outputted according to the weighting of gradation by a subframe conversion circuit. This color image data is inputted and each pixel of that color image data ****** electro-optic device 14 drives by the writing of that color image data, and read-out. As a result, the green light which enters into the electro-optic device 10 is modulated, and the projection display of the picture of green light is carried out to the screen 16. The timing to which illuminant light penetrates the blue area (for example, 12B1) of the rotation light filter 12 is also the same. Thus, the color image corresponding to the colored light generated by time amount sequential with rotation of the rotation light filter 12 will be generated one by one by the electro-optic device 14, and the color picture for one frame will be displayed. Although an order of colored light generation was set as R, G, and B by this true form voice, it may not be limited to this and what kind of order may be sufficient as it.

0066 In the electro-optic device 14 in the color picture generating device 10 of this Embodiment 1. as described above, the color image data (digital data) corresponding to a color subframe period (sf) is preceded, and it writes in and has a function which reads the color image data corresponding to a corresponding color subframe period -- it has substrate (substrate for electro-optic devices) 23 for panels.

0067 Hereafter, the composition of the substrate 23 for panels of the electro-optic device 14 used for the color picture generating device 10 of this Embodiment 1 is explained.

0068 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit which made drawing 5 to the substrate for panels of the high-reflective-liquid-crystal panel as the electro-optic device 14 in this Embodiment 1 (substrate for electro-optic devices), A timing chart for the circuit diagram and drawing 7 in which the pixel circuit where drawing 6 is contained in it is shown to explain operation of a pixel circuit, and drawing 8 are the timing charts for explaining operation of an active-matrix-liquid-crystal display device drive circuit.

0069 The substrate 23 for high-reflective-liquid-crystal panels used by this Embodiment 1, An active device and a capacitative element are made to the principal surface of a single crystal semiconductor substrate, and an interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0070 The active-matrix-liquid-crystal display device drive circuit 50 shown in drawing 5 is provided with the following.
The active matrix circuit 51 made directly under the picture element region of a semiconductor substrate.
The signal line driving circuit (X driver) 52 for sending into signal electrode (X)X1 addressed to one - Xm the color image digital signal (Data) which carries out ingress by serial transfer from the above-mentioned subframe conversion circuit 20 the whole pixel row of the active matrix circuit 51.
The scanning line driving circuit (Y driver) 53 for sending a selection timing signal into the scanning electrode Y1 (Y11-Yn1) addressed to four, Y2 (Y12-Yn2), Y3 (Y13-Yn3), and Y4 (Y14-Yn4) the whole pixel row for choosing the pixel row of the active matrix circuit 51.
The signal line driving circuit 52 and the scanning line driving circuit 53 constitute the peripheral circuit to the active matrix circuit 51.
0071 The insulated gate field effect transistor which is a switch element of n piece multiple connection for the signal line driving circuit 52 to distribute the color image digital signal (Data) of a serial signal to the signal electrode X1 - Xm one by one for every pixel selection period. (it is hereafter called MOSFET.) -- the pixel signal sampling circuit 52a which it has, and the shift clock CLX and the signal wire shift register (X shift register) 52b which generates the switch drive timing pulse phiH1 - phiHm on a target one by one based on latch pulse DX at each switch element are comprised. Have the scanning line driving circuit 53 in the pixel row based on the shift clock CLY and the scanning start pulse (frame start pulse) DY, and the scanning line shift register (Y shift register) 53a which generates the line drive timing pulse phiV1 - phiVn on a target one by one further, The selection timing pulse phi 1 for choosing Ythe scanning electrode Y1 addressed to four, Y2, Y3, or 4 the whole pixel row based on the line drive timing pulse phiV1 - phiVn and liquid crystal AC converted signal (signal which switches for every frame) FR - phi4. It has the selection timing circuit 53b to generate.
0072 In ******** of the matrix intersection part of the signal electrode X in which the active matrix circuit 51 extends in a line direction, and the scanning electrode Y which extends in a line writing direction, the pixel circuit 55 shown in drawing 6 is made. The sample hold circuit 56 where this pixel circuit 55 carries out sample hold of odd number subframe color image digital signal **of color image digital signal V (H level or L level) sent into the signal electrode X** V (O), and the even number subframe color image digital signal V (E) by turns, Odd number subframe color image digital signal V (O) and even number subframe color image digital signal V (E) are read from the sample hold circuit 56 to the degree of a subframe change by turns, and the picture element electrode 28 is consisted of the pixel driving circuit 57 which performs a pixel drive by voltage drive.
0073 The sample hold circuit 56 consists of the 1st sample hold circuit 56a and the 2nd sample hold circuit 56b, and the 1st sample hold circuit 56a, It consists of MOSFET(insulated-gate field-effect transistor) Tof ** 1st1 of N type with the gate G electrically connected to the source S and the 1st scanning electrode Y1 which are electrically connected to the signal electrode X, and the 1st retention volume C1 electrically connected to the drain D. The 2nd MOSFET (T2) of N type which has the electrically connected gate G in the source S and the 2nd scanning electrode Y2 which the 2nd sample hold circuit 56b is also the same composition, and electrically connect it to the signal electrode X, The 2nd retention volume C2 electrically connected to the drain D is comprised.
0074 The 3rd MOSFET (T3) of N type with which the pixel driving circuit 57 of this Embodiment 1 has the electrically connected gate G in the source S and the 3rd scanning

electrode Y3 which are electrically connected to the 1st retention volume C1, The 4th MOSFET (T4) of N type which has the gate G electrically connected to the source S and the 4th scanning electrode Y4 which are electrically connected in the 2nd retention volume C2, It consists of the 5th MOSFET (T5) of N type with the source S electrically connected to the drain D and the picture element electrode 28 which are electrically connected to the gate G and the pixel driving source Vdd which electrically connect with the drain D of the 3rd MOSFET (T3) and the 4th MOSFET (T4). The 3rd MOSFET (T3) and 4th MOSFET (T4), Constitute a signal reading means which reads odd number subframe color image digital signal V (O) and even number subframe color image digital signal **from the 2nd retention volume C2** V (E) from the 1st retention volume C1 to a degree of a subframe change by turns, and the 5th MOSFET (T5), A common pixel driving means which impresses the pixel driver voltage Vdd to the picture element electrode 28 according to read odd number subframe color image digital signal V (O) and even number subframe color image digital signal V (E) is constituted.

0075 Although the composition of the selection timing circuit 53b is mentioned later, from the selection timing circuit 53b, the selection timing pulse phi 1 - phi4 which are shown in drawing 7 are generated. In odd number color subframe period 1sf, the 1st write-in timing pulse phi 1 is the 1st scanning electrode Y1. If it generates upwards, The 1st MOSFET (T1) of the 1st sample hold circuit 56a carries out Kaisei, odd number subframe color image digital signal **on the signal electrode X** V (O) is sampled, and the signal V (O) is written in the 1st retention volume C1. In even number color subframe period 2sf just behind that, the 2nd write-in timing pulse phi 2 is the 2nd scanning electrode Y2. If it generates upwards, The 2nd MOSFET (T2) of the 2nd sample hold circuit 56b carries out Kaisei, even number subframe color image digital signal **on the signal electrode X** V (E) is sampled, and the signal V (E) is written in the 2nd retention volume C2. Odd number subframe color image digital signal V (O) is written in the 1st retention volume C1 of the pixel circuit 55 of all the pixels by point sequential in odd number color subframe period 1sf, Even number subframe color image digital signal V (E) is written in the 2nd retention volume C2 of the pixel circuit 55 of all the pixels by point sequential in even number color subframe period 2sf. A concurrency is carried out to the mutual writing operation for such every color subframe period, odd number color subframe period 1sf is covered, and the 2nd write-in timing pulse phi 4 is the 4th scanning electrode Y4. Since it is continuing generating upwards, Since even number subframe color image digital signal V (E) held by Kaisei of the 4th MOSFET (T4) temporarily at the 2nd retention volume C2 is read, The 5th MOSFET (T5) conducts by even number subframe color image digital signal V (E), and liquid crystal cell LC electrically connected to the picture element electrode 28 drives. Even number color subframe period 2sf is covered, and the 1st write-in timing pulse phi 3 is the 3rd scanning electrode Y3. Since it is continuing generating upwards, Since odd number subframe color image digital signal V (E) held by Kaisei of the 3rd MOSFET (T3) temporarily at the 1st retention volume C1 is read, The 5th MOSFET (T5) conducts by odd number subframe color image digital signal V (O), and liquid crystal cell LC electrically connected to the picture element electrode 28 drives. In a liquid crystal device, liquid crystal cell LC serves as a pixel driven to an ON state or an OFF state via the picture element electrode 28.

0076 Although the write-in system of this Embodiment 1 is a dot sequential system, the write-in sequential one only stops at the sample hold circuit 56, and it does not actualize it as pixel drive sequential. For this reason, a subframe change display simultaneous in all the pixels can be performed, and the unevenness of a display screen can be canceled. It is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized. Since the simultaneous stillness display of all the pixels of a front subframe is realizable between sample hold operations of a back subframe, display time and a write time cannot conflict, but protraction of display time can be realized, and much more high definition-ization can be attained. Since a write period can also be lengthened, the simplification of peripheral circuit composition is realizable.

0077 The selection timing circuit 53b for generating the selection timing pulse phi 1 - phi4 which are shown in drawing 7, In the inverter INV which reverses liquid crystal AC

converted signal FR for every color subframe as shown in drawing 5, and each pixel row, Line drive timing pulse phiV (phiV1 - phiVn) from the and (AND) gate A1 and the Y shift register 53a which, on the other hand, considers line drive timing pulse phiV (phiV1 - phiVn) from the Y shift register 53a as an input, and considers liquid crystal AC converted signal FR as an another side input. It consists of the and (AND) gate A2 which considers it as an input on the other hand, and considers an inverter output (FR bar) as an another side input. the output of AND gate A1 -- the 1st scanning electrode Y1 -- supply the output of AND gate A2 to the 2nd scanning electrode Y2, an inverter output (FR bar) is supplied to the 3rd scanning electrode Y3, and AC converted signal FR is supplied to the 4th scanning electrode Y4, respectively. Two AND gates A1 and A2 are equivalent to the scanning electrode selection circuitry which chooses the 1st scanning electrode Y1 and 2nd scanning electrode Y2 by turns for every color subframe period.

0078 According to this Embodiment 1, as described above, the color subframe period (1sf, 2sf -- 12sf) of 12 is contained within the color subframe period 1F specified with the rotation light filter 12. In 1st color subframe period 1sf located in the beginning of the 1 frame period 1F as shown in drawing 8, If liquid crystal AC converted signal FR rises, as shown in drawing 7, the 2nd read-out timing pulse phi 4 will generate, the 4th MOSFET (T4) of each pixel circuit 55 will carry out Kaisei, and the 1st read-out timing pulse phi 3 disappears, and the 3rd MOSFET (T3) closes. In this color subframe period 1sf, the line drive timing pulse phiV1 - phiVn generate on a target one by one from the Y shift register 53a. AND gate A1 of the pixel of the 1st line serves as one with the line drive timing pulse phiV1 generated in the pixel of the 1st line in this color subframe period 1sf, and a high level of liquid crystal AC converted signal FR, The 1st write-in timing pulse phi 1 generates, and the 1st MOSFET (T1) carries out Kaisei. Similarly, whenever the line drive timing pulse phiV2 - phiVn generate the whole horizontal period one by one, the 1st write-in timing pulse phi 1 generates to the pixel row, and the 1st MOSFET (T1) carries out Kaisei.

0079 next, / within the horizontal period which the 1st write-in timing pulse phi 1 of the pixel of the 2nd line generates , Since X shift register 52b generates the switch drive timing pulse phiH1 - phiHm on a target one by one synchronizing with the shift clock CLX, The sampling circuit 52a carries out serial parallel conversion of the color image digital signal (Data) of a serial signal, and the color image digital signals V1-Vm are distributed to the signal electrode X1 for every pixel row - Xm. When the switch drive timing pulse phiH1 occurs, it is the signal electrode X1. The upper color image digital signal V1 is written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the 1st row of the pixel of the 2nd line. Next, when the switch drive timing pulse phiH2 occurs, it is the signal electrode X2. The upper color image digital signal V2 is written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the 2nd row of the pixel of the 2nd line. Finally, if phiHm occurs in a switch drive timing pulse, the color image digital signal Vm on the signal electrode Xm will be written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the m-th row of the pixel of the 2nd line.

0080 Thus, if color image digital signal **of 1st color subframe period 1sf** V (O) is written in the 1st retention volume C1 of all the pixel circuits 55 by point sequential, In the 2nd next color subframe period 2sf, As shown in drawing 8, liquid crystal AC converted signal FR falls, as shown in drawing 7, the 1st read-out timing pulse phi 3 generates, and the 3rd MOSFET (T3) of each pixel circuit 55 carries out Kaisei, and. The 2nd write-in timing pulse phi 4 disappears, and the 4th MOSFET (T4) closes. For this reason, the pixel signals V1-Vm of each line written in by 1st color subframe period 1sf are read to the 1st retention volume C1 of all the pixel circuits 55 via the 4th MOSFET (T4), According to the pixel signals V1-Vm of each line, the 5th MOSFET (T5) carries out Kaisei, and liquid crystal cell LCs electrically connected to the picture element electrode 28 drive all at once.

0081 As shown in drawing 8, also in this color subframe period 2sf, the line drive timing pulse phiV1 - phiVn generate on a target one by one from the Y shift register 53a. AND gate A2 of the pixel of the 1st line serves as one with the line drive timing pulse phiV1 and H level of an inverter output (FR bar) by which it was generated in the pixel of the

1st line in this color subframe period 2sf, The 2nd write-in timing pulse phi 2 generates, and the 2nd MOSFET (T2) carries out Kaisei, and the 1st MOSFET (T1) closes. Similarly, whenever the line drive timing pulse phiV2 - phiVn generate the whole horizontal period one by one, the 2nd write-in timing pulse phi 2 generates to the pixel row, and the 2nd MOSFET (T2) carries out Kaisei.

0082 In the horizontal period which the 2nd write-in timing pulse phi 2 of the pixel of the 2nd line generates here, Since X shift register 52b generates the switch drive timing pulse phiH1 - phiHm on a target one by one synchronizing with the shift clock CLX, The sampling circuit 52a carries out serial parallel conversion of the color image digital signal (Data) of a serial signal, and the color image digital signals V1-Vm are distributed to the signal electrode X1 for every pixel row - Xm. passing the 2nd MOSFET (T2), as mentioned above since the 2nd MOSFET (T2) of all the pixel circuits 55 of the pixel of the 2nd line is continuing and carrying out Kaisei of each signal electrode X1 - the pixel signals V1-Vm on Xm to the horizontal period -- the 2nd retention volume C2 -- a dot order -- next, it is written in. The pixel signals V1-Vm of each line of this color subframe period 2sf are read all at once in the next odd number color subframe period (3sf), and the simultaneous drive of all the pixels is carried out. Similarly, operation with same color subframe period (4sf) or later is performed.

0083 According to this Embodiment 1, color image generation respectively corresponding to color subframe period 1sf specified with the rotation light filter 12 - 12sf is selectively performed according to a weighting of gradation. And in each color subframe period sf, since the whole color subframe period sf of a color to which color image data written in by preceding corresponds is covered and it reads and generates **color image** , luminosity of a color image generated during the selected color subframe period sf can be improved substantially. A gradation display of a picture can be ensured by choosing the color subframe period sf within the 1 frame period 1F. Although the color subframe period sf within the 1 frame period 1F is an example whose number is even, this Embodiment 1, Since color image data corresponding to the color subframe period sf can be written in by time amount sequential even if the number of color subframe periods within the 1 frame period 1F is odd, it is convenient in any way.

0084(Embodiment 2) Drawing 9 is a front view showing a rotation light filter used for Embodiment 2 of a color picture generating device concerning this invention, and drawing 10 is a timing chart which shows timing of colored light generation and each color image generation in this Embodiment 2. This Embodiment 2 explains only a point which composition of the rotation light filter 12 differs to the above-mentioned composition of Embodiment 1, and is different. The same mark is given to the above-mentioned Embodiment 1 and identical parts, and the explanation is omitted.

0085 The rotation light filter 120 used with the color picture generating device of this Embodiment 2, The group of the light filter 120R1 of the sector form where angle width is the narrowest as shown in drawing 9 which consists of a group with three angle width, 120G1, and 120B1, The group of the light filter 120R2 of the sector form where angle width is wider than this group's light filter, 120G2, and 120 B-2, It consists of a group of the light filter 120R3 of the largest sector form of angle width, 120 G3, and 120B3, and it is provided in one and becomes so that these may constitute a circle. And it has set up so that the period which this rotation light filter 120 rotates one time may become the same as that of 1 frame period (1F) of the picture generated with the electro-optic device 14 like the Embodiment 1 above-mentioned also in this Embodiment 2. That is, it is set up rotate one time at 1 frame period (1F). The number of rotations to 1 frame period (1F) of such a rotation light filter 120 is suitably set up according to the number of the gradation levels and color subframe periods (sf) which are demanded, and is not limited to what rotates 1 frame-period (1F) per 1.

0086 When rotating the rotation light filter 120 one time in this Embodiment 2 at 1 frame period (1F), Time for the light from the light source 11 to penetrate one of each of the light filter 120R (1-3), 120G (1-3), and 120B (1-3) which constitutes the rotation light filter 120 turns into a color subframe period (sf). During **this** the color subframe (sf), the length of time differs among different groups.

0087 And as shown in the timing chart of drawing 10, corresponding to the color

subframe period (sf) of each color, image generation of each color is performed to 3 times. In the inside RSF (1-3), GSF (1-3), and BSF of the said figure (1-3), the subframe period by the side of the color image generation by which the image data read to a corresponding color subframe period is generated is shown. Since it originates in the composition of the rotation light filter 120 and the color subframe period sf of three different length is set up in this Embodiment 2, The method of selection of the color subframe period sf that such length differs within 1 frame period in the case of each image generation can perform efficient gray scale representation. In connection with having set up the three length of the color subframe period sf in this way, as for the output timing of a color image digital signal, the writing timing of the color image digital signal in a picture element part, and read timing, setting out is changed suitably. Other composition in this Embodiment 2 is the same as that of the above-mentioned Embodiment 1. Other operation and effects in this Embodiment 2 are the same as that of the above-mentioned Embodiment 1.

0088 Although the three color subframe periods sf when the length of time differs were set up in this Embodiment 2, the color subframe period when the length of the color subframe period when the length of two time differs, or four time or more differs may be set up. For example, if several n of a color subframe period is 8, the ratio of the length of eight color subframe periods so that it may become either of the n-th power (n is zero or more integers) of 2, respectively, The ratio of the length of a period by making it set to $1(=2^0):2(=2^1):4(=2^2):8(=2^3):16(=2^4):32(=2^5):64(=2^6):128\ (=2^7)$. The number Hmax of maximum gradation is realizable 256 times. Namely, the length of each time of two or more color subframe periods which constitute the generation period of each colored light within 1 frame period, If the number of maximum gradation is set to Hmax by setting to CT quota time of the colored light of each color generated within 1 frame period, it will become one which satisfies CT and 2^m/Hmax of length. And what is necessary is just to set up the angle width of each light filter of the rotation light filter 120, in order to set up the ratio of such a color subframe period. In this Embodiment 2, although an order within the group of the light filter of identical angle width was uniformly set up in the rotation light filter 120, the light filter in which angle width differs may be set as an unfixed order like the rotation light filter 120A shown, for example in drawing 11. In this example, while being able to perform efficient gray scale representation, it is effective in it becoming possible to make it hard to be conspicuous in the color which is easy to be perceived.

0089(Embodiment 3) Drawing 12 shows Embodiment 3 of a color picture generating device concerning this invention, and a color picture generation method. This Embodiment 3 applies this invention to a color picture generating device of a direct viewing type which equips the display screen front side (drawing 12 upper part) with a lighting system (front light). 3 colored light emitted by color sequential from the front side is generated during the color subframe, and this Embodiment 3 is set up so that timing of color image generation with an electro-optic device as an image generation part may be in agreement during the color subframe of each colored light.

0090 As shown in drawing 12, the electrochromatic display 100 of this Embodiment 3 is provided with the drive circuit 103 which drives and controls the lighting system 101, the electro-optic device 102, and these lighting systems 101 and the electro-optic device 102 of a color change type. In drawing 12, since the lighting system 101 is arranged to the front side, it is considered as a reflection type electro-optic device, and a high-reflective-liquid-crystal display device is used like the above-mentioned Embodiment 1.

0091 Composition of the color change type lighting system 101 is provided with the source 101R of red luminescent light, the source 101G of green luminescent light, the source 101B of blue luminescent light, and the reflector 104 that turns to a display screen of the electro-optic device 102 colored light emitted from these, and is reflected, for example. These light sources 101R, 101G, and 101B can apply a light source of various kinds of colored light, such as fluorescent tubes, such as a cold cathode tube and a hot cathode tube, EL (electroluminescence) light emitting device, and LED.

0092 Since composition of the reflection type electro-optic device 102 is the same as composition explained by Embodiment 1, explanation is omitted.

0093 The drive circuit 103 is provided with the following.
Microprocessor 105.
Timing generator 106.
Frame memory 107.
The subframe conversion circuit 108, the light source color switcher 109, and the power supply 110 for light sources.
Change timing of the light source color switcher 109 and color image generating timing of the electro-optic device 102 are controlled by this color picture generating device 100 with the timing generator 106. First, it is made to sample in a sampling circuit which does not illustrate image data, and a synchronized signal in an image input signal is sent to the microprocessor 105 and the timing generator 106. Simultaneously with it, image data in image data is written in the frame memory 107 to timing controlled by the timing generator 106. The lighting system 101 of a color change type is the light source color switcher 109 controlled by the timing generator 106 so that it may synchronize with generating timing of each color image of the electro-optic device 102, As for time, the source 101R of red luminescent light, the source 101G of green luminescent light, and the source 101B of blue luminescent light are turned on repeatedly one by one. thus, the lighting system 101 -- the same color order as a foreground-color picture -- next colored light is generated and it is illuminated by the reflection type electro-optic device 102. It is reflected light modulation being given by the electro-optic device 102, and colored light (light for a display) of each color irradiated in this way performs a color image display by color sequential.
0094 For example, from the timing generator 106, a light source change timing signal is supplied to the light source color switcher 109, current supply is made from the power supply 110 for light sources to a selected light source, and the red light light source 101R lights up so that the lighting system 101 may emit light in red light. So that it may synchronize with change timing in this light source color switcher 109, From the timing generator 106, a read timing signal is supplied to the frame memory 107, Image data of a red ingredient made to memorize beforehand in a driving period before this is read one by one, The subframe conversion circuit 108 which receives the image data outputs a color image digital signal to the electro-optic device 102 prior to a corresponding color subframe period set up with the lighting system 101 according to a weighting of gradation of a color image for red ingredients. In the electro-optic device 102 which receives this color image digital signal, it continues during **that wrote a color-picture-elements digital signal in each picture element part, and synchronized with a corresponding color subframe period / this** the whole color subframe, and a color image for red is generated. Timing control of the timing generator 106 is carried out so that timing of each component may be synchronized in response to control of the microprocessor 105. In the electro-optic device 102, red light is modulated for every pixel and a picture of red light is generated. Therefore, a picture is displayed on a display screen by red light by which light intensity was modulated for every pixel.
0095 Next, in timing which makes the green light light source 101G turn on with the lighting system 101. Like a case of red light, image data for green light is read from the frame memory 107, relating with a color subframe period is performed according to a weighting of gradation by the subframe conversion circuit 108, and a color image digital signal is outputted to the electro-optic device 102. According to it, by each picture element part of the electro-optic device 102, the color image digital signal is written in prior to a corresponding color subframe period, it reads synchronizing with a corresponding color subframe period, and color image generation is performed. A liquid crystal pinched by this picture element electrode and common electrode in connection with this modulates blue glow, and pictures of green light are displayed on a color subframe period corresponding to a display screen of the electro-optic device 102 all at once. Next, timing which the blue glow light source 101B turns on with the lighting system 101 is also the same. Thus, it will be generated by the color subframe period sequential to which a color image of colored light of three colors corresponds with the electro-optic device 102, and a color picture will be displayed by repeating this cyclically within 1 frame period.

0096 Timing and color image generating timing of colored light generation of the color subframe period sf of this Embodiment 3 are good also as timing as shown in drawing 3 like the above-mentioned Embodiment 1, and, As shown in drawing 10 like the above-mentioned Embodiment 2, time length of each group's color subframe period sf is good also as timing which synchronizes color image generation with these color subframe periods as mutually different length. And the number of groups of a color subframe period is not limited. The number of color subframe periods is good also as a number which is different for every color within 1 frame period. Occurrence order of a color of a color subframe period may not be limited in order of R, G, and B, and what kind of order may be sufficient as it.
0097(Embodiment 4) Drawing 13 is a circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels for the electro-optic device (high-reflective-liquid-crystal panel) used with the color picture generating device concerning Embodiment 4 of this invention. According to this Embodiment 4, it is characterized by performing writing and read-out for the color image digital signal which a weighting is carried out and is generated one by one as for time by a picture element part by turns using Y shift register for odd number subframes, and Y shift register for even number subframes. That is, a picture element part is controlled by turns using a Y shift register which is different according to a generation order of two or more color subframe periods sf located in a line by time amount sequential in the odd-numbered color subframe period and the even-numbered color subframe period within the 1 frame period 1F. This Embodiment 4 is a thing using the high-reflective-liquid-crystal panel of the same composition as the electro-optic device 14 (see drawing 4) in the above-mentioned Embodiment 1, The active-matrix-liquid-crystal display device drive circuit made to the substrate 23 for panels of this electro-optic device 14 (substrate for electro-optic devices) differs from Embodiment 1. The same reference mark is attached and explained to the composition and identical parts of Embodiment 1 in drawing 13.
0098 The substrate 23 for panels of this Embodiment 4 makes an active device and a capacitative element like Embodiment 1 to a principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of a rectangle of a large number arranged by matrix form in a picture element region which occupies an active area superficially.
0099 The active-matrix-liquid-crystal display device drive circuit 60 of this Embodiment 4 has the same active matrix circuit 51 and signal line driving circuit (X driver) 52 as Embodiment 1. A scanning line driving circuit has somewhat different composition from a thing of Embodiment 1. The whole pixel row Inside of the scanning electrode Y1 addressed to four, Y2, Y3, and Y4, The 3rd scanning electrode Y3 As the 1st upper read-out timing pulse phi 3, liquid crystal AC converted signal (signal which switches for every frame) FR, The 4th scanning electrode Y4 An output (FR bar) of a point used, respectively which reversed liquid crystal AC converted signal FR with the inverter INV as the 2nd upper read-out timing pulse phi 4 is the same as that of Embodiment 1.
0100 However, composition of a write timing circuit for generating the 1st write-in timing pulse phi 1 supplied to the 1st scanning electrode Y1 and the 2nd write-in timing pulse phi 2 supplied to the 2nd scanning electrode Y2 differs. This write timing circuit, Y shift register 53aa for odd frames which passes 1st write-in timing pulse phi11-phi1n to each pixel row, passes the 1st scanning electrode Y1 to a target one by one, respectively, and is generated during the odd number color subframe based on the shift clock CLY and odd frame start pulse DY1, Based on the shift clock CLY and even-frame start pulse DY2, during the even number color subframe, pass 2nd write-in timing pulse phi21-phi2n to each pixel row, and the 2nd scanning electrode Y2 is passed to a target one by one, respectively. Y shift register 53ab for even frames generated on a target one by one is comprised.
0101 Also in the active-matrix-liquid-crystal display device drive circuit 60 which has such Y shift register 53aa for odd frames, and Y shift register 53ab for even frames, Since the write-in timing pulse phi 1 to each pixel row and generation of phi 2 are unchanging with it of Embodiment 1, the same operation effect as Embodiment 1 can be

obtained. In addition, since the shift speed by the side of Y is changed the whole field, it is convenient to interpolation processing of an interlace signal, etc.

0102 As mentioned above, although the composition and operation of the substrate 23 for panels of the electro-optic device 14 used by this Embodiment 4 were explained, other composition in the color picture generating device of this Embodiment 4 is the same as that of the above-mentioned Embodiment 1, and its operation and effect are the same.

0103(Embodiment 5) The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit which made drawing 14 to the substrate for panels of the electro-optic device (high-reflective-liquid-crystal panel) in the color picture generating device concerning Embodiment 5 of this invention, Drawing 15 is a timing chart explaining operation of the timing circuit. The same reference mark is attached and explained to the composition and identical parts of Embodiment 1 in drawing 14.

0104A substrate for panels of this Embodiment 5 also makes an active device and a capacitative element to a principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of a rectangle of a large number arranged by matrix form in a picture element region which occupies an active area superficially.

0105 The active-matrix-liquid-crystal display device drive circuit 70 of this Embodiment 5 has the same active matrix circuit 51 as Embodiment 1, the signal line driving circuit (X driver) 52, and the Y shift register 53a. In this Embodiment 5, the color subframe period sf of R, G, and B is contained in time sequences at the 1 full frame period 1F.

0106 As a read timing circuit of Embodiment 1, between opening read timing circuit 53ab is provided. In the meantime empty read timing circuit 53ba, A D type flip-flop (FF) which sets to data input D liquid crystal AC converted signal FR' which switches for every color subframe while setting the blanking period setting clock BCK to clocked into CK, And (AND) gate A3 and the NOR (NOR) gate N1 which consider the output Q of the liquid crystal AC converted signal FR' and D type flip-flop (FF) as an input are comprised.

0107 Since a color image digital signal (Data) is transferred serially in order of R color subframe, G color subframe, and B subframe, in the pixel circuit 55. As shown in drawing 15, writing operation of G color subframe is performed at the read-out driving period of R color subframe, Writing operation of B color subframe is performed at the read-out driving period of the following G color subframe, and writing operation of R color subframe is performed at the read-out driving period of the following B color subframe.

0108 Since liquid crystal AC converted signal FR' which carries out a police box to the blanking period setting clock BCK the whole subframe is inputted into the D type flip-flop (FF), Since the output Q of a D type flip-flop (FF) will rise when only blanking period Tb is delayed from the standup point in time of liquid crystal AC converted signal FR' if liquid crystal AC converted signal FR' rises, Output RE2 of the NOR (NOR) gate N1 falls synchronizing with the standup of liquid crystal AC converted signal FR', and output RE1 of AND gate A3 rises synchronizing with the standup of the output Q. Output RE1 is supplied to the gate of the 3rd MOSFET (T3) via the 3rd scanning electrode Y3 as 1st read-out timing pulse phi3 ', Since output RE2 is supplied to the gate of the 4th MOSFET (T4) via the 4th scanning electrode Y4 as 2nd read-out timing pulse phi4 ', Only blanking period Tb vacates from the time of the 4th MOSFET (T4) closing, and the 3rd MOSFET (T3) carries out Kaisei. Therefore, in order that the 4th MOSFET (T4) and 3rd MOSFET (T3) may close simultaneously at the time of a frame period change, mixture of B signal and R signal does not take place, and additive color mixture at the time of a hue lighting-system change is not gathered.

0109 Since the output Q of a D type flip-flop (FF) will fall when only blanking period Tb is delayed from the falling point in time of liquid crystal AC converted signal FR' if liquid crystal AC converted signal FR' falls, Output RE1 of AND gate A3 falls synchronizing with falling of liquid crystal AC converted signal FR', and output RE2 of NOR gate N1 rises synchronizing with falling of the output Q. For this reason, only blanking period Tb vacates from the time of the 3rd MOSFET (T3) closing, and the 4th MOSFET (T4) carries out Kaisei. Therefore, in order that the 4th MOSFET (T4) and 3rd MOSFET (T3) may carry

out simultaneous closing at the time of a subframe change, mixture of R signal and G signal does not take place, and additive color mixture at the time of a hue lighting-system change is not gathered. Similarly, mixture of G signal and B signal does not take place, and additive color mixture at the time of a hue light source change is not gathered.

0110 Thus, in order that blanking period Tb may be vacated and the 4th MOSFET (T4) and 3rd MOSFET (T3) may open and close exclusively in this Embodiment 5, Since both do not penetrate and additive color mixture at the time not only of mixture of holding signals not occurring but a hue lighting-system change is not gathered, a high-definition colored presentation can be performed. Thus, it becomes possible to perform good color picture generation especially in a color sequential field sequential system by adding between opening read timing circuit 53ab to composition. Mixture of the holding signals at the time of a frame change can be prevented by losing certainly simultaneous Kaisei of the 4th MOSFET (T4) and the 3rd MOSFET (T3) at the time of a frame change.

0111 Since other composition in this Embodiment 5 is the same as that of the above-mentioned Embodiment 1, it can do so same operation and the effect as Embodiment 1.

0112(Embodiment 6) A circuit diagram showing the active-matrix-liquid-crystal display device drive circuit 80 which made drawing 16 to a substrate for panels of an electro-optic device in a color picture generating device concerning Embodiment 6 of this invention, Drawing 17 (A) is a timing chart for a circuit diagram and drawing 17 (B) in which the pixel circuit is shown to explain operation of the pixel circuit. In drawing 16, the same reference mark is given to composition and identical parts of Embodiment 1, and the explanation is omitted.

0113 The substrate for panels of this Embodiment 6 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.

0114 The active-matrix-liquid-crystal display device drive circuit 80 of this Embodiment 6 is provided with the signal line driving circuit (X driver) 52 and the Y shift register 53a like Embodiment 1 shown in drawing 5, and the composition of the pixel circuit 82 of the active matrix circuit 81 differs in the pixel circuit 55 of Embodiment 1. The sample hold circuit 83 which carries out the sample hold of the even number color subframe signal V (E) to odd number color subframe signal **of color image digital signal V sent into the signal electrode X** V (O) by turns as the pixel circuit 82 of this Embodiment 6 is shown in drawing 17 (A), The pixel driving circuit 84 which reads odd number color subframe signal V (O) and the even number color subframe signal V (E) from the sample hold circuit 83 by turns the whole frame, carries out the voltage drive of the picture element electrode 28, and performs a pixel drive is comprised.

0115 The sample hold circuit 83 consists of the 1st sample hold circuit 83a and the 2nd sample hold circuit 83b, and the 1st sample hold circuit 83a, It consists of the 1st MOSFET (Q1) of N type with the gate G electrically connected to the source S and the 1st scanning electrode Y1 which are electrically connected to the signal electrode X, and the 1st retention volume C1 electrically connected to the drain D. The 2nd MOSFET (Q2) of the P type which has the electrically connected gate G in the source S and the 2nd scanning electrode Y2 which the 2nd sample hold circuit 83b is also the same composition, and electrically connect it to the signal electrode X, It consists of the 2nd retention volume C2 electrically connected to the drain D. The 1st MOSFET (Q1) and 2nd MOSFET (Q2) serve as a reverse conductivity type, and constitute what is called CMOS. For this reason, the 1st write-in TAIN ming pulse phi 1 for the 1st MOSFET (Q1) a standup pulse, Since the 2nd write-in TAIN ming pulse phi 2 for the 2nd MOSFET (Q2) needs the falling pulse, The 2nd scanning electrode Y2 of the selection timing circuit 53b which showed drawing 5 write-in TAIN ming circuit 53b' of this Embodiment 6 AND gate A2 of ** is replaced with NAND gate N2.

0116 On the other hand, the 3rd MOSFET (Q3) of the P type with which the pixel driving circuit 84 has the electrically connected gate G in the source S and the 3rd scanning

electrode Y3 which are electrically connected to the 1st retention volume C1, The 4th MOSFET (Q4) of the N type which has the gate G electrically connected to the source S and the 3rd scanning electrode Y3 which are electrically connected in the 2nd retention volume C2, It consists of the 5th MOSFET (Q5) of N type with the source S electrically connected to the drain D and the signal electrode 14 which are electrically connected to the gate G and the pixel driving source Vdd which electrically connect with the drain D of the 3rd MOSFET (Q3) and the 4th MOSFET (Q4). With the 3rd MOSFET (Q3) and the 4th MOSFET (Q4), it is a reverse conductivity type and what is called CMOS is constituted. In order to open and close the 3rd MOSFET (Q3) and 4th MOSFET (Q4) exclusively with like-pole nature gate voltage, the common read-out timing pulse phi 3 is supplied to both the gates G via the 3rd only scanning electrode Y3. Therefore, one number of the scanning electrode addressed to a pixel row is reducible.
0117 In this Embodiment 6, the comparatively high voltage from which the counterelectrode (common electrode; LC.COM) 27 by the side of the opposite transparent base 25 which is made to counter the substrate 23 for panels and is assembled switches for every frame is impressed.
0118 For this reason, since the potential of counterelectrode LC.COM is straight polarity in odd number color subframe period 1sf as shown in drawing 17 (B), when the 4th MOSFET (Q4) carries out Kaisei, a holding signal is read and the 5th MOSFET (Q5) carries out Kaisei, the potential difference of the signal electrode potential (power supply potential Vdd) by the side of an anode and the potential of counterelectrode LC.COM by the side of a cathode has the relatively considerable power supply potential Vdd also at low pressure -- it is large. Since the potential of counterelectrode LC.COM becomes negative polarity in even number color subframe period 2sf, when the 3rd MOSFET (Q3) carries out Kaisei, a holding signal is read and the 5th MOSFET (Q5) carries out Kaisei, the potential difference of the signal electrode potential by the side of a cathode and the potential of counterelectrode LC.COM by the side of an anode is also relatively considerable -- it is large.
0119 Thus, by performing what is called a common way that carries out the police box of the potential of counterelectrode (common electrode) LC.COM for every subframe, Since the dynamic range of a signal impressed to the picture element electrode 28 not to mention the ability to prevent degradation of liquid crystal cell LC can be relatively made small, formation becomes possible by using MOSFET of the pixel circuit 82 as a low resisting pressure element. Thereby, an element miniaturization can realize reduction of an occupation area and increase of a numerical aperture can realize high-density high definition display equipment.
0120 As mentioned above, although the composition of the substrate 23 for panels of the electro-optic device 14 of this Embodiment 6 was explained, other composition in this Embodiment 6 is the same as that of the above-mentioned Embodiment 1, and does so same operation and the effect as Embodiment 1.
0121(Embodiment 7) Drawing 18 is a circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels of the electro-optic device in the color picture generating device concerning Embodiment 7 of this invention. In drawing 18, the same reference mark is given to the composition and identical parts of Embodiment 4 and Embodiment 6, and the explanation is omitted.
0122 The substrate for these embodiment 7 panels also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0123 The active-matrix-liquid-crystal display device drive circuit 85 of this Embodiment 7, Like Embodiment 4 shown in drawing 13, the signal line driving circuit (X driver) 52, Y shift register 53aa for odd frames, It has the active matrix circuit 81 with the pixel circuit 82 like Embodiment 6 which is provided with Y shift register 53ab for even frames, and is shown in drawing 16 and drawing 17. Therefore, this Embodiment 7 does so same operation and the effect as Embodiment 4 and Embodiment 6.

0124 As mentioned above, although Embodiment 1 of the color picture generating device concerning this invention and a color picture generation method - Embodiment 7 were described, Although the substrate for panels makes a switching element from these embodiments to the principal surface of a semiconductor substrate, not only as a semiconductor substrate but as a substrate, insulating substrates, such as a glass substrate and a quartz substrate, can be used. Even when forming a thin film transistor (TFT) etc. on an insulating substrate as a switching element, it cannot be overemphasized that this invention is applicable. In these Embodiments 1 - Embodiment 7, write-in sequential ones does not turn into pixel drive sequential simultaneously irrespective of a dot sequential system or a line sequential color TV system, Since it only stops at temporary storage sequential, and write-in sequential one is not actualized as pixel drive sequential but a change display simultaneous in all the pixels can do the color image corresponding to each color subframe period, the unevenness of a display screen can be canceled and the good high-definition color picture generating device of gray scale representation can be provided. Since a change display simultaneous in this way can be performed, it is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized.
0125 Although these Embodiments 1 - Embodiment 7 were the composition provided with what is called a capacitor memory of making the retention volume C1 and C2 memorizing the writing of a color image digital signal, they can also be considered as the composition which makes static memory for every pixel and makes a digital value memorize. Embodiment 8 and Embodiment 9 which are described below are the example which made static memory for every pixel.
0126(Embodiment 8) The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit which made drawing 19 to the substrate for panels in Embodiment 8 of the color picture generating device concerning this invention, The circuit diagram showing the digital store circuit which drawing 20 (A) provides for every pixel of an active-matrix-liquid-crystal display device drive circuit, The timing chart drawing 20 (B) explains operation of the digital store circuit to be, and drawing 21 are the timing charts explaining overall operation of an active-matrix-liquid-crystal display device drive circuit.
0127 The substrate for panels of this Embodiment 8 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0128 The active-matrix-liquid-crystal display device drive circuit 90 shown in drawing 19 is provided with the following.
The matrix circuit 91 made directly under the picture element region (viewing area) of a semiconductor substrate.
The shift register 92 for serial parallel conversion (a signal electrode driving circuit, X driver) for sending into signal electrode (X)X_0 - X_m addressed to one the color image digital signal (DATA) which carries out ingress by serial transfer by line sequential the whole pixel row of the matrix circuit 91.
the digital store circuit M for every pixel of the matrix circuit 91 (M_{00} - M_{nm}) -- order of rows -- the next -- a latch control signal (writing timing signal) -- the scanning electrode Y addressed to pixel row 2, $_1$ **and (Y_{10} - Y_{1n})** The scanning electrode driving circuit (Y driver) 93 for sending in via Y_2 (Y_{20} - Y_{2n}).
The 2nd timing pulse for carrying out the simultaneous drive of all the picture element electrodes 28 (it read-out-clock-pulse-RCK(s) (phi 3), and a non-inverter) Scanning electrode Y_3 addressed to every pixel row 2 (Y_{30} - Y_{3n}) which transmits the read-out clock pulse RCK bar (phi 4) of an opposite phase, Y_4 (Y_{40} - Y_{4n}).
The shift register 92 for serial parallel conversion and the scanning electrode driving circuit 93 constitute the peripheral circuit to the matrix circuit 91 of a central picture element region here.
0129 The shift register 92 for serial parallel conversion carries out shift transmission of

the color image digital signal (DATA=D_0 - D_m) of a serial sequence synchronizing with the shift clock CLX, and makes the color image digital signal corresponding to signal electrode X_0 - X_m top appear for every horizontal period. The scanning electrode driving circuit 93, The scanning electrode shift register (Y shift register) 93a which carries out shift transmission of the scanning start pulse (frame start pulse) DY synchronizing with the shift clock CLY, and generates line drive timing pulse phi_0 - phi_n on a target one by one on a pixel row for every vertical period, It consists of the latch timing circuit 93b which writes in with line drive timing pulse phi_0 - phi_n, and generates the 1st timing pulse (the latch control pulse phi 1 of a non-inverter, the latch control pulse phi 2 of an opposite phase) on the scanning electrode Y1 and Y2 based on the clock pulse WCK, respectively.
0130 While writing in this latch timing circuit 93b with line drive timing pulse phi_0 corresponding in each pixel row - phi_n and outputting a logical product with the clock pulse WCK on 1st scanning electrode Y_1 as the latch control pulse phi 1 of a non-inverter, They are logic circuit G_0 which outputs the inverted output of the logical product output phi 1 on 2nd scanning electrode Y_2 as the latch control pulse phi 2 of an opposite phase - G_n.
0131 In each of the matrix intersection part of the signal electrode X which extends in a line direction, and the scanning electrode Y which extends in a line writing direction, the digital store circuit M (M_{00} - M_{nm}) shown in drawing 20 (A) is made by the matrix circuit 91. Each of this digital store circuit M is provided with the following.
It has the memory output Q which impresses driver voltage to the picture element electrode 28 which counters with data input D and the common electrode 27 which the arrival ******** digital signal Di inputs into the signal electrode Xi, and pinches the liquid crystal 26, The 1st latch circuitry L1 that incorporates and stores temporarily the color image digital signal Di which arrives at the signal electrode Xi in the precedence color subframe period (it is the odd-numbered color subframe period for example, within 1 frame period) sf.
The 2nd latch circuitry L2 outputted to the memory output Q while reading the color image digital signal Di stored temporarily in the 1st latch circuitry L1 in the lagging color subframe period (even-numbered color subframe period) sf before the latch operation of the 1st latch circuitry L1 and storing it temporarily.

0132 The 1st latch circuitry L1 is provided with the following.
1st N channel type MOSFET for data transfer that incorporates a color image digital signal synchronizing with the latch control pulse phi 1 of a non-inverter of 1st scanning electrode Y_{i1} (T1).
1st synchronous method flip-flop F1 that carries out temporary storage operation of the data which passed 1st MOSFET for data transfer (T1) synchronizing with disappearance of the latch control pulse phi 2 of an opposite phase on 2nd scanning electrode Y_{i2}.
The 2nd latch circuitry L2 is provided with the following.
2nd N channel type MOSFET for data transfer that incorporates output data of 1st synchronous method flip-flop F1 synchronizing with the read-out clock pulse RCK (phi 3) of a non-inverter on 3rd scanning electrode Y_{i3} (T2).
The 2nd synchronous method flip-flop F2 that carries out temporary storage operation synchronizing with disappearance of the latch control pulse phi 4 of an opposite phase on 4th scanning electrode Y_{i4}, and outputs data which passed 2nd MOSFET for data transfer (T2) to the memory output Q.

01331st synchronous method flip-flop F1 is provided with the following.
The two inverter INV1 and 1st double inverting circuit that made round connection of INV2.
1st N channel type MOSFET for hold-stores control that separates temporarily an electrical link of an input of the first rank INV1, and an output of return stage INV2 synchronizing with the latch control pulse phi 2 of an opposite phase (Q1).
2nd synchronous method flip-flop F1 is provided with the following.
The 2nd double inverting circuit that made round connection of two inverter INV3 and

INV4.
2nd MOSFET for hold-stores control that separates temporarily an electrical link of an input of the first rank inverter INV3, and an output of return stage inverter INV4 synchronizing with the read-out timing pulse phi 4 of an opposite phase (Q2).

0134 In **as shown in the timing chart of drawing 21** 1st color subframe period 1sf, If liquid crystal AC converted signal FR which switches for every subframe rises, while the read-out timing pulse RCK (phi 3) of a non-inverter will generate on 3rd scanning electrode Y_{30} - Y_{3n} synchronizing with the standup, The read-out timing pulse RCK (phi 4) of an opposite phase generates on 4th scanning electrode Y_{40} - Y_{4n}. The scanning start pulse DY is added to the scanning electrode shift register 93a at the same time AC converted signal FR rises, While line drive timing pulse phi_0 - phi_n generate on a target one by one synchronizing with the shift clock CLY produced in a constant interval, the write-in clock pulse WCK occurs and occurs synchronizing with the shift clock CLY. For this reason, while latch control pulse phi1 $_0$ of a non-inverter - phi1 $_n$ (phi 1) generate on 1st scanning electrode Y_{10} of a pixel row - Y_{1n}, On 2nd scanning electrode Y_{20} - Y_{2n}, latch control pulse phi2 $_0$ of an opposite phase - phi2 $_n$ (phi 2) generate.
0135the **therefore, / the 1st -** -- the pulses phi1-phi4 are generated by scanning electrode Y_{i1} of four - Y_{i4} in an order shown in drawing 20 (B). If the latch control pulses phi1 and phi2 occur on 1st scanning electrode Y_{i1} and 2nd scanning electrode Y_{i2} during the write-in period W1 of a precedence color subframe period (for example, 1sf), In 1st synchronous method flip-flop F1, while one **1st MOSFET for data transfer (T1)** , Since 1st MOSFET for hold-stores control (Q1) turns off, the output of return stage inverter INV2 does not return to first rank inverter INV1, The logical value of the lead data D1 from 1st MOSFET for data transfer (T1) is impressed by first rank inverter INV1, and the reversal logical value appears in the output of first rank inverter INV1. After the latch control pulses phi1 and phi2 disappear and write in and the period W1 expires, while 1st MOSFET for data transfer (T1) turns off, Since one **1st MOSFET for hold-stores control (Q1)** , the output of return stage inverter INV2 returns to first rank inverter INV1, and the storage operation of 1st synchronous method flip-flop F1 re-functions, The reversal logical value of the lead data (color image digital signal) D1 is stored temporarily at 1st synchronous method flip-flop F1.
0136 If it reads on 3rd scanning electrode Y_{i3} and 4th scanning electrode Y_{i4} in the read-out period R1 of the next lagging color subframe period (for example, 2sf) and the clock pulses phi3 and phi4 occur, In the 2nd synchronous method flip-flop F2, while one **2nd MOSFET for data transfer (T2)** , Since 2nd MOSFET for hold-stores control (Q2) turns off, the output of return stage inverter INV4 does not return to first rank inverter INV3, The reversal logical value of the lead data D1 from 1st synchronous method flip-flop F1 is impressed by first rank inverter INV3, and the reversal logical value (lead data D1) appears in the output of first rank inverter INV3. After the read-out clock pulses phi3 and phi4 disappear and read and the period W1 expires, while 2nd MOSFET for data transfer (T2) turns off, Since one **2nd MOSFET for hold-stores control (Q2)** , the output of return stage inverter INV4 returns to first rank inverter INV3, and the storage operation of the 2nd synchronous method flip-flop F2 re-functions, While the lead data D1 is stored temporarily at the 2nd synchronous method flip-flop F2, the memory output Q continues being supplied to the picture element electrode 28. Then, if the latch control pulse phi 1 and 2 occur on 1st scanning electrode Y_{i1} and 2nd scanning electrode Y_{i2} during the write-in period W2, the memory content of 1st synchronous method flip-flop F1 will be rewritten by the lagging data D2 like the order mentioned above.
0137 Although the writing system of this Embodiment 8 is a line sequential color TV system, the write-in sequential one only stops at 1st synchronous method flip-flop F1, the 2nd synchronous method flip-flop F2 writes in, and sequential does not spread. For this reason, a subframe change display simultaneous in all the pixels can be performed in each color subframe period sf, and the unevenness of a display screen can be canceled. Since the simultaneous stillness display of all the pixels of a front color subframe can be realized between the writing operation of a back color subframe, it can moreover continue during the whole color subframe and a color image can be displayed, High

definition-ization can be attained, while display time and writing time do not conflict within 1 frame period but raise luminosity.
0138 In this Embodiment 8, the 2nd flip-flop F2 is functioning as a driver who carries out the static drives of the picture element electrode 28. Unlike an active matrix driven, there is no attenuation of a pixel driving signal and a perfect digital drive is attained.
0139the 1st and 2nd above-mentioned MOSFET for data transfer (T1, T2) -- mutual -- turning on and off exclusively -- both 1st and 2nd MOSFET(Q1, Q2) MO for hold-stores control, although it turns on and off exclusively, By using mutually the 1st and 2nd MOSFET for data transfer (T1, T2) as a reverse conductivity type, and using mutually 1st and 2nd MOSFET for hold-stores control (Q1, Q2) as a reverse conductivity type, It is not necessary to send the both sides of a non-inverter pulse and an opposite phase pulse to the digital store circuit M, and scanning electrodes can be reduced two.
0140 As mentioned above, although the substrate for panels of the electro-optic device used with the color picture generating device of Embodiment 8 was explained, other composition and effects in this Embodiment 8 are the same as that of the above-mentioned Embodiment 1.
0141(Embodiment 9) Drawing 22 is a circuit diagram showing the digital store circuit made to the substrate for panels of the electro-optic device in Embodiment 9 of the color picture generating device concerning this invention (substrate for electro-optic devices). In drawing 22, the same mark is given to the composition and identical parts of Embodiment 8, and the explanation is omitted.
0142 The substrate 23 for panels in this Embodiment 9 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially. Although it has the same shift register 92 for serial parallel conversion and scanning electrode driving circuit 93 as the above-mentioned Embodiment 8 which also described this Embodiment 9 above, the composition of digital store circuit M' differs from the digital store circuit M of Embodiment 8.
0143 Digital store circuit M' is provided with the following.
It has the memory output Q which impresses driver voltage to the picture element electrode 28 which pinches the liquid crystal 26 on data input D which the color image digital signal Di which arrives at the signal electrode Xi inputs like the digital store circuit M, and the common electrode 27, The 1st latch circuitry L1' that incorporates and stores temporarily the color image digital signal Di which arrives at the signal electrode Xi in a precedence color subframe period (for example, odd number color subframe period).
The 2nd latch circuitry L2' outputted to the memory output Q while reading the color image digital signal Di stored temporarily in 1st latch circuitry L1' in the lagging color subframe period (for example, even number color frame period) before the latch operation of 1st latch circuitry L1' and storing it temporarily.

01441st latch circuitry L1' is provided with the following.
The 1st clocked inverter K1 that considers the color image digital signal Di as an input, and carries out logic operation synchronizing with the latch control pulse phi 1 of the non-inverter of 1st scanning electrode Y_{i1}.
1st synchronous method flip-flop F1' that carries out temporary storage operation of the output data synchronizing with disappearance of the latch control pulse phi 2 of the opposite phase on 2nd scanning electrode Y_{i2}.
2nd latch circuitry L2' is provided with the following.
The clocked inverter K2 which considers the output data of 1st synchronous method flip-flop F1' as an input, and carries out logic operation synchronizing with the read-out clock pulse RCK (phi 3) of the non-inverter on 3rd scanning electrode Y_{i3}.
2nd synchronous method flip-flop F2' that carries out temporary storage operation synchronizing with disappearance of the read-out clock pulse RCK bar (phi 4) of the opposite phase on 4th scanning electrode Y_{i4}, and outputs the output data to the memory

output Q.

01451st synchronous method flip-flop F1' is the two inverter INV1 and 1st double inverting circuit that made round connection of INV2', The return stage inverter INV2' is a clocked inverter which interrupts logic operation synchronizing with the latch control pulse phi 2 of an opposite phase, 2nd synchronous method flip-flop F2' is also the two inverter INV3 and 2nd double inverting circuit that made round connection of inverter INV4', and is a clocked inverter for which the return stage INV4' interrupts logic operation synchronizing with the read-out clock pulse phi 4 of an opposite phase.
0146 If the latch control pulses phi1 and phi2 occur on the 1st scanning electrode Yi1 and 2nd scanning electrode Yi2 during the write-in period W1 of a precedence color subframe period (for example, 1sf) as this Embodiment 9 is shown in drawing 20 (B), In 1st synchronous method flip-flop F1', while the 1st clocked inverter K1 carries out logic operation, In order that return stage inverter INV2' may interrupt logic operation, the output of return stage inverter INV2' does not return to first rank inverter INV1, The logical value of the precedence color image digital signal D1 from the 1st clocked inverter K1 is impressed by inverter INV1 of the first rank, and the logical value appears in the output of first rank inverter INV1. After the latch control pulses phi1 and phi2 disappear and write in and the period W1 expires, while the 1st clocked inverter K1 interrupts logic operation, In order that return stage inverter INV2' may carry out logic operation, the output of return stage inverter INV2' returns to first rank inverter INV1, and the storage operation of 1st synchronous method flip-flop F1' re-functions, The precedence color image digital signal D1 is stored temporarily at 1st synchronous method flip-flop F1'.
0147 In **if it reads on the 3rd scanning electrode Yi3 and 4th scanning electrode Yi4 in the read-out period R1 of the next lagging color subframe period (for example, 2sf) and the clock pulses phi3 and phi4 occur** 2nd synchronous method flip-flop F2', While the 2nd clocked inverter K2 carries out logic operation, in order that return stage inverter INV4' may interrupt logic operation, The output of return stage inverter INV4' does not return to first rank inverter INV3, The reversal logical value of the precedence color image digital signal D1 from 1st synchronous method flip-flop F1' is impressed by first rank inverter INV3, and the reversal logical value (precedence color image digital signal D1) appears in the output of first rank inverter INV3. After the read-out clock pulses phi3 and phi4 disappear and read and the period R1 expires, while the 2nd clocked inverter K1 interrupts logical-value operation, In order that return stage inverter INV4' may carry out logic operation, the output of return stage inverter INV4' returns to first rank inverter INV4, and the storage operation of 2nd synchronous method flip-flop F2' re-functions, While the precedence color image digital signal D1 is stored temporarily at 2nd synchronous method flip-flop F2', the memory output Q continues being supplied to the picture element electrode 28. Then, if the latch control pulses phi1 and phi2 occur on the 1st scanning electrode Yi1 and 2nd scanning electrode Yi2 during the write-in period W2, the memory content of 1st synchronous method flip-flop F1' will be rewritten by the lagging color image digital data D2 like the order mentioned above.
0148 As mentioned above, although a substrate for panels of an electro-optic device of a color picture generating device of this Embodiment 9 was explained, other composition in this Embodiment 9 is the same as that of above-mentioned Embodiment 1 and Embodiment 8, and does same operation effect so.
0149 In this Embodiment 9, by digital store circuit M', since a clocked inverter is used, it is effective in reduction of power consumption, waveform shaping, and energy amplification, and can contribute to certain-ization of storage operation. It is also possible to use 3 State buffer instead of clocked inverter K1 and K2.
0150 As mentioned above, although Embodiment 1 - Embodiment 9 were described, a color picture generating device of these embodiments is applicable to various kinds of electronic devices, such as a liquid crystal projector, a word processor, and a personal computer, for example. Various kinds of change which is not limited to the above-mentioned Embodiment 1 - Embodiment 9, and accompanies a summary of composition is possible for this invention. For example, in the above-mentioned Embodiment 1 - Embodiment 9, although a reflection type liquid crystal panel was applied as an electro-

optic device, DMD (digital micro mirror device) may be applied. DMD modulates light volume which makes the degree of angle of inclination of a reflective mirror change according to a color image digital signal for every pixel, and enters into a projector lens. According to color image data, Pulse Density Modulation (PWM) of time width which more specifically turns to a projector lens light reflected by reflective mirror, and the time width which makes an absorber absorb light reflected is carried out, and it enables it to modulate intensity of colored light for every pixel. And color image digital data provided in a substrate for panels (substrate for electro-optic devices) which was used by an embodiment which a reflective mirror described above to a substrate arranged at matrix form, a means (a thing provided with a capacitor memory which was described above.) which read said data to a correspondence color subframe period all at once while memorizing prior to a corresponding color subframe period By making a thing provided with static memory build in, the angle changing drive of the reflective mirrors of each pixel can be carried out to a color subframe period all at once.
0151 In the above-mentioned Embodiment 1 - Embodiment 9, although the reflection type liquid crystal panel was applied as an electro-optic device, colored light is made to penetrate using a transmission type electro-optic device like a transmission type liquid crystal panel, and light intensity may be modulated. In the case of a liquid crystal panel, polarizing elements, such as a polarizing plate, are required at least at one side by the side of colored light incidence of a panel, and outgoing radiation (unnecessary in the case of a light scattering type liquid crystal). Namely, although this invention has been explained by making a reflection type electro-optic device into a subject in each embodiment, The color image display device and the method of presentation of a field sequential system of this invention which can be been and set, May constitute as a projection type display which carries out the projection display of the light modulated by penetrating a transmission type electro-optic device to a screen, and, The lighting system 101 shown in drawing 12 at the back side may be arranged, the colored light from there may be modulated with a transmission type electro-optic device, and it may constitute as a display device which faces the transmitted light squarely.
0152 It cannot be overemphasized that this invention is not limited to the number of partitions of length setting out of the above-mentioned color subframe period of each embodiment and the color generation period within 1 frame period, and it can change suitably according to the gradation level of a color image.
0153 Although 3 colored light of red light, green light, and blue glow made into colored light explained in the above-mentioned embodiment, 3 colored light of cyanogen light, magenta light, and yellow light may be sufficient, and more colored light than two-color light and 3 colored light can also be used.

Field of the Invention About the color picture generating device which drives this invention with a field sequential system, and performs color picture generation, a color picture generation method, and an electronic device, in more detail, It is related with an electronic device provided with the color picture generating device, color picture generation method, and color picture generating device of the digital drive which can perform a gradation display easily.

Description of the Prior Art There are some which perform a colored presentation within a single dot as a color picture generating device with time lag mixed colors, i.e., the additive color mixing by a time-division-driving system. In such a color picture generating device, since 1 pixel turns into one picture element, there is an advantage that one 3 times the resolution of this is obtained as compared with the color picture generating device which performs juxtaposition mixed colors.
0003 As a color picture generating device of such a field sequential system, R which generated the light from a white light source through the rotation light filter (red), the

colored light of G (green) and B (blue) -- time order -- next, it glares on an electro-optic device, and it displays with this electro-optic device, or there are some which make the colored light which was modulated with the electro-optic device, and was reflected or penetrated project on a screen, and display a color picture.

0004 In order to perform a gradation display with such a color picture generating device, There is what is called a Pulse-Density-Modulation drive system that divides 1 frame period (one vertical scanning period) during **two or more** the subframe, chooses a subframe period suitably within 1 frame period according to the gradation of a display image, and outputs an image generation signal. When setting up a subframe period in image generation, as shown in drawing 24, R of the rotation light filter 1, Each colored filter of G and B is equally divided into two, and two or more subframe periods are assigned within the period which has each colored filter 1R, 1G, 1B, 2R, and 2G and 2B in the position into which the white light irradiated from a light source enters. Namely, the period when the 1st red filter 1R is chosen as shown in drawing 25. (It is hereafter called a colored light generation period) It is a subframe period (1 SF) of four image generation in 1R. 2SF, 3SF, and 4SF are assigned, and the subframe period (5SF, 6SF, 7SF, 8SF) of four image generation is assigned within R light generation period 2R when the 2nd red filter 2R is chosen.

0005 And an electro-optic device generates the gradation of each colored light for every pixel by driving each pixel with the pulse width modulation which modulates colored light with the binary of ON and OFF, and changing the pulse width of ON and OFF according to picture information. For example, a pixel is driven and colored light is modulated for every pixel so that colored light may be penetrated or (in the case of a transmission type electro-optic device) reflected only during the ON (in the case of a reflection type electro-optic device). In the case of drawing 25, within eight subframe periods which exist in 1 frame period, it corresponds, respectively, eight weighting periods of the gradation in pulse width modulation are arranged, and the level of gradation is controlled by in any of eight subframe periods a pixel is set to ON. The same drive is performed also in the green filter or the blue filter.

0006 As the above-mentioned example and an example which assigned two or more subframe periods within one colored light generation period similarly, the sequential color imaging method concerning the JP,H8-51633,A description is known. Drawing 26 is a timing chart which shows the relation between the colored light generation (color subframe) period in this sequential color imaging method, and each color image generation signals.

Problem to be solved by the invention However, in the color picture generating device of the above-mentioned field sequential system, two or more subframe periods are assigned by the image generation side within 1 colored-light generation period. Therefore, it is necessary to carry out the address of each pixel for every subframe period, and to impress the image data which decides whether to drive a pixel in the subframe period to each pixel. Since the addressing period of a pixel would be included for every subframe period, the more the pixel number increased, the addressing period occupied during the colored light generation became long, and, the more there was a problem that the period when a color image is generated substantially was short.

0008 In the scanning line selection period which chose the scanning line when transmission was started, for example in the division colored light generation period, the data signal of the 1st line pixel of the 1st row is refreshed -- having (rewritten) -- in the pixel of others of the 1st line, or the pixel of the 2nd less than line, the signal of the front subframe remains as it is. For this reason, in order that the modulation operation (display action) of the colored light in each pixel and the operation which writes image data in each pixel one by one may carry out synchronization within the 1 display period of a picture (inside of the vertical scanning period which displays one screen), The display portion by the image data written in the front subframe in the 1 display screen and the display portion by the image data written in in the present subframe are

intermingled. therefore, the substitute of the beginning of the period when colored light was generated -- hurrah, in a period, all the image data for colored light in the front colored light generation period written in in the last frame period is the generation periods of the present colored light until it is rewritten -- being also alike -- it will not be involved but abnormal conditions will be made by the image data of front colored light. Also in the subframe period within a colored light generation period, although all the image data before being written in in the last subframe period is the subframe periods of ** until it is rewritten, abnormal conditions will be made by front image data. Thereby, the unevenness of mixed colors, or gradation degradation and a display screen arises.
0009 Since a write-in period can be shortened when pixel numbers are comparatively few display screens, Although vision is hard to be carried out, the part and all the pixel display periods when the write-in period of all the pixels becomes long become short, the unevenness of a display screen actualizes, and the unevenness of the above display screens causes deterioration of image quality, and the fall of luminosity, so that it increases a pixel number. Of course, in a signal line driving circuit, although not a point sequential drive system but a line sequential drive system is employable, Even in this case, since **of the picture corresponding to a front subframe, and the picture corresponding to a back subframe** it cut and replaced, the pixel advanced by line sequential and it has appeared on the display screen as it is, the unevenness of a display screen arises too. When a pixel number is increased, deterioration of image quality is further caused by the unevenness of a display screen. For this reason, big-screen-izing or highly-minute-izing by the number of high pixels had a limit. Since the period assigned during the weighting for substantial Pulse Density Modulation becomes short, pulse width for a gradation display cannot fully be secured, and good color picture generation cannot be performed.
0010 Then, the issue which this invention tends to solve is at the point what kind of means should be provided, in order to obtain the color picture generating device, color picture generation method, and electronic device which can perform the good gradation display without brightness lowering.

Means for solving problem In order to solve above-mentioned SUBJECT, the means provided by this invention, The colored light generation part as for which time comes out one by one and which generates two or more colored light within 1 frame period, respectively, The image generation part which generates the color image for every colored light by time sequential corresponding to this colored light generation part, While it is a color picture generating device of a ******** field sequential system, and the generation period of each colored light divides during **two or more** the division colored light generation and is arranged within 1 frame period, The weighting period of the gradation of the color image in an image generation part and the division colored light generation period corresponding to this color are abbreviated-in agreement, and an image generation part generates a color image selectively to a division colored light generation period according to the weighting of gradation.
0012 Since the division colored light generation period which divides the generation period of colored light, and the weighting period of the gradation of the color image in an image generation part are abbreviated-in agreement according to such composition of this invention, the color image in which it continued during the division colored light generation, and the weighting of the gradation was carried out is generable. For this reason, the ratio of the image generation period to a division colored light generation period is high, and luminosity of a display image can be made high. Since **on which a division colored light generation period spreads abbreviation etc. during the weighting of the gradation of a color image** it is set up, it has the effect that the gradation display of a color image can be performed efficiently.
0013 As for this invention, it is preferred that a group period when it locates at a time one period of division colored light generation periods which generate mutually different colored light by time amount sequential comes out one by one in time, and are provided

within 1 frame period. **two or more** Since a division colored light generation period of a different color is arranged by time amount sequential according to such composition, it becomes possible to perform time lag additive color mixing of a color image generated good. if an order of a color of colored light generated within this group period is fixed, it will set up in order of a repetition of colored light which does not perceive sense of incongruity to a generated image -- things can be carried out. On the contrary, when making unfixed an order of a color of colored light generated within a group period, it becomes possible to avoid an order of a color of colored light which is easy to be perceived.

0014 It is good also as composition which sets mutually a division colored light generation period of colored light of the same color as an equal period in this invention. According to such composition, it is effective in control with colored light generating timing of a colored light generation part and color image generating timing of an image generation part becoming easy, and composition of a subframe conversion circuit in an image generation part becoming easy.

0015 As for this invention, it is preferred that a division colored light generation period of colored light of the same color is set as a mutually different period. According to such composition, it has the effect that many gradation numbers are realizable with the number of selections of a division colored light generation period with few each pixel within 1 frame period, by choosing a division colored light generation period according to a weighting of gradation of a color image. The length of each time of a division colored light generation period of said plurality (n:2 or more integers) which constitutes a generation period of each colored light within 1 frame period specifically, When quota time of colored light of each color generated within 1 frame period is set to CT and the number of maximum gradation is set to Hmax, it is preferred to set it as one which satisfies CT and 2^{m}/Hmax (however, m integer of less than or more 0n) of length. For example, if several n of a division colored light generation period is 8, a ratio of the length of eight division colored light generation periods, It is set to $1(=2^{0}):2(=2^{1}):4(=2^{2}):8(=2^{3}):16(=2^{4}):32(=2^{5}):64(=2^{6}):128\ (=2^{7})$, and the number Hmax of maximum gradation can be realized 256 times. Incidentally, drawing 23 shows a case where a pixel is driven using a pulse modulation (PWM) system. Drawing 23 (A) shows a data period defined by Vertical Synchronizing signal VSYN. The figure shows driving a pixel to an ON state by each pixel during **each** the colored light generation with pulse width corresponding a colored light generation period in one scan period to gradation only by dividing into three. Drawing 23 (B) shows among (A) what kind of pulse width can be chosen as a generation period of R light about red light.When indicating each colored light by gradation by 4-bit image data, pulse width of eight different length of 2^{0} - 2^{7} is generated by pulse width, and 256 gradation can be displayed by combining this pulse width. An example of a pulse of the 170th gradation in 256 gradation is shown in the figure. A pulse may be made to continue like a case where a pulse is distributed like the 2nd from under a figure as timing which carries out a pulse width drive, and the lowest. It is made more desirable **for a pulse to continue** and a gap of gradation depended for a pulse shape becoming blunt can be prevented. A pulse cannot be doubled with a front tip but can also be doubled with a trailing edge.

0016 In this invention, each of a period of pulse width of two or more kinds of this length that is followed to pulse width modulation and kicked is equivalent to "a weighting period in pulse width modulation" for expressing a gradation level of each pixel. And although a weighting period by each of this pulse width shifts a pulse and is positioned one by one within 1 frame period by drawing 23, In this invention, the above-mentioned weighting period is assigned for every division colored light generation period which makes a weighting period by this pulse width continue, does not generate, and is distributed and generated within 1 frame period for every colored light. Therefore, the number of division colored light generation periods for every colored light and the number of weighting periods of pulse width modulation (the number of kinds of pulse width) turn into the same number fundamentally. What is necessary is just to position a weighting period within the period, if the division colored light generation period is set up for a long time than equivalent although the length of a division colored light generation period and a

weighting period may not correspond. Although a mutual weighting period may give a relation of the length of a multiple of 2, it is preferred to adjust the length of a period so that the nonlinear characteristic (it is called the gamma characteristic) of light transmittance (reflectance) of an electro-optic device may be compensated and gradation may become a linear change.

0017 It can have composition provided with a light source and the rotation light filter which generates two or more colored light based on the light from this light source as a colored light generation part in this invention. According to such composition of this invention, it has the effect that the drive and control by the side of a light source become very easy, by using light including the wavelength band region of two or more colored light. In this invention, in order for what is necessary just to be to rotate a rotation light filter with predetermined revolving speed, this also has the effect that the colored light where a drive and control became easy and was stabilized is generable.

0018 As a colored light generation part in this invention, it can have a light source which generates two or more colored light, respectively, and these light sources can have composition changed and turned on by time amount sequential. According to this invention of such composition, since two or more colored light is directly generable with a light source, it has an effect which raises the utilization efficiency of colored light.

0019 It is preferred to be able to use a reflection type electro-optic device and to use especially a liquid crystal device as an image generation part in this invention. According to this invention of such composition, a good gradation display can be performed, for example in the display device of a direct viewing type, and a projected type display device. A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device in this invention, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a liquid crystal device using the double reflex of liquid crystals, such as a liquid crystal device, OCB, ECB mode, etc. which the cell gap of the TN liquid crystal cell was set up narrowly, and a light scattering type liquid crystal using a polymer dispersed liquid crystal, are applicable. Micro mirror devices, such as a digital micro mirror device (DMD), are applicable as an electro-optic device. According to this invention, luminosity of the display image of the electro-optic device of field sequential systems including a liquid crystal device can be made high by leaps and bounds as compared with the former, and it has the effect that a bright color picture is generable.

0020 This invention is characterized by having a substrate for electro-optic devices of the following composition, in order to raise luminosity of a color picture and to perform a gradation display good. A substrate for electro-optic devices which it has by this invention can be used as a substrate of digital drive type display devices, such as a liquid crystal device, DMD, a field emission device, a plasma display, an electroluminescence device, and LED.

0021 Namely, as an electro-optic device applied to this invention, Pixel drive operation which reads a precedence color image digital signal which equipped a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode with a substrate for electro-optic devices with which a picture element electrode was formed, respectively, and was stored temporarily for every pixel at it, and carries out a pixel drive, A pixel circuit performed while shifting memory signals one by one in concurrency corresponds, respectively, and is made, and temporary storage operation to a lagging color image digital signal of the same pixel outputted to a signal electrode after a precedence color image digital signal. It is arranged by transparent base which counters this substrate for electro-optic devices, and pinches electrooptic material and which has a counterelectrode, and said precedence color image digital signal, It is color image data corresponding to the division colored light generation period concerned which reads and carries out a pixel drive synchronizing with said division colored light generation period, and is considering as composition that a lagging color image digital signal is a color image digital signal corresponding to a division colored light generation period located at

the next of the division colored light generation period.
0022 Although timing which stores a signal of the same pixel temporarily at retention volume, and timing which carries out the pixel drive of the electrooptic material are in agreement in the conventional pixel circuit, Timing which stores a signal from a signal electrode temporarily according to the color picture generating device of this invention, Since timing which reads the temporary storage signal and drives a pixel can be positively shifted within fixed time (for example, division colored light generation period), it continues during the next division colored light generation, and a simultaneous drive (simultaneous stillness display) of all the pixels can be realized.
0023 In this invention, since writing only stops at temporary storage sequential irrespective of a dot sequential system or a line sequential color TV system, it does not actualize as pixel drive sequential, but write-in sequential one can perform a frame (subframe) change display simultaneous in all the pixels. Thereby, unevenness of a display screen can be canceled and a high-definition color picture generating device can be provided. For this reason, it is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized. It continues during the division colored light generation, a simultaneous drive (simultaneous stillness display) of all the pixels can also be realized, and display time and a write time do not conflict, but substantial display time can be lengthened as compared with a color picture generating device of the conventional field sequential system. For this reason, much more high definition-ization can be attained in this invention. It continues during the color subfield, temporary storage operation of all the pixels can also be realized, and a write period can be lengthened. Therefore, it becomes possible to attain low speed-ization of a signal transfer rate, and simplification and formation of a high pixel number of peripheral circuit composition can be realized. It has the effect that frame memories for indicative datas which carry out external to a substrate for electro-optic devices are reducible etc.
0024 As such a pixel drive delayed type pixel circuit, The temporary storage operation which incorporates the color image digital signal from a signal electrode Two or more sample hold means exclusive at time sharing which it is, and are carried out and are performed on a target one by one, The momentary holding signal from each sample hold means is read, and it has an exclusive pixel driving means which it is, and is carried out and is performed on a target one by one for pixel drive operation by time sharing. Generally, it is enough if constituted only from the 1st and the 2nd sample hold means as a sample hold means. In this case, it becomes the same **the pixel driving period of a precedence color image digital signal** as the write period of a lagging color image digital signal.
0025 In this invention, a more than **3rd** sample hold means may be established. Since the write period of a lagging color image digital signal can also be made into twice (N-1) the pixel driving period of a precedence color image digital signal, for example when it has N sample hold means, A signal transfer rate can be low-speed-ized further, and the simplification and the formation of a high pixel number of peripheral circuit composition will become remarkable. If two sample hold means are established like this invention, for example in the case of a field sequential system, G color subframe signal (G color image digital signal) can be written in R division colored light generation period. B color subframe signal (B color image digital signal) can be written in G division colored light generation period. R color subframe signal (R color image digital signal) can be written in B division colored light generation period. Thus, although what is necessary is just composition provided with two sample hold means in a field sequential system, it is good also as composition which establishes three sample hold means, for example. According to such composition, it can continue R division colored light generation period and during the G division colored light generation, and B frame signal (B color image digital signal) can be written in. It can continue G division colored light generation period and during the B division colored light generation, and R color subframe signal (R color image digital signal) can be written in. Similarly, it can continue B division colored light generation period and during the R division colored light generation, and G color subframe signal (G color image digital signal) can be written in.
0026in this sample hold means, one signal electrode a quota ******** case to each

pixel, After serial parallel conversion of the serial signal on one signal electrode is distributed and carried out to a precedence color image digital signal and a lagging color image digital signal in two or more sample hold means, it stores temporarily, respectively. In this case, the number of the scanning electrode for controlling the selection timing of two or more sample hold means is **number of sample hold means** needed. For example, when it provides the 1st and the 2nd sample hold means, one signal electrode and two scanning electrodes are needed. On the contrary, when providing the signal electrode only for an odd frame, and the signal electrode only for even frames, for example, one scanning electrode can be shared, and the 1st and the 2nd sample hold means do not perform the function as a serial-parallel-conversion means any longer, but only a temporary storage function is achieved.
0027 In this invention, as the 1st above-mentioned sample hold means, the 1st signal holding means, The 1st signal code book lump means that opens and closes with the 1st write timing signal, and samples the signal (color image digital signal) on a signal electrode to the 1st signal holding means, It **** and has the 2nd signal holding means and the 2nd signal code book lump means that opens and closes with the 2nd write timing signal, and samples the signal (color image digital signal) on said signal electrode to said 2nd signal holding means as said 2nd sample hold means. The precedence color image digital signal corresponding to the division colored light generation period of precedence, For example, while being held by the 1st signal code book lump means temporarily at the 1st means holding mechanism, the lagging color image digital signal corresponding to the division colored light generation period of lagging is held by the 2nd signal code book lump means temporarily at the 2nd signal holding means.
0028 The 1st signal code book lump means is specifically used as the 1st transistor that one terminal electrically connects with a signal electrode, and other terminals electrically connect to the 1st signal holding means, One terminal electrically connects with a signal electrode, and the 2nd signal code book lump means can be used as the 2nd transistor that other terminals electrically connect to the 2nd signal code book lump means. Here, the transistor can use not only a mono- Poral but a bipolar transistor.
0029 This invention is characterized by having a substrate for electro-optic devices of the following composition, in order to raise the luminosity of a color picture and to perform a gradation display good. The substrate for electro-optic devices which it has by this invention can be used as a substrate of digital drive type display devices, such as a liquid crystal device, DMD, a field emission device, a plasma display, an electroluminescence device, and LED.
0030 Namely, this invention is provided with the substrate for electro-optic devices with which the picture element electrode was formed in the pixel corresponding to the matrix intersection of a scanning electrode and a signal electrode, respectively, For said every pixel. Shifting in concurrency the static drive operation of a picture element electrode based on the precedence color image digital signal which carried out temporary storage maintenance, and the temporary storage operation to the lagging color image digital signal of the same pixel that arrives at said signal electrode after fixed time from the precedence color image digital signal one by one. The digital memory measure to perform corresponds, respectively, and is made, and. The transparent base which counters this substrate for electro-optic devices, and pinches electrooptic material and which has a counterelectrode is arranged, A precedence color image digital signal is a signal corresponding to the weighting of the gradation corresponding to the division colored light generation period concerned read synchronizing with a corresponding division colored light generation period, It considers as composition that a lagging color image digital signal is a signal corresponding to the weighting of the gradation corresponding to the subframe period located at the next of the division colored light generation period to precede.
0031 The timing which stores temporarily the color image digital data from a signal electrode according to this invention of such composition, In order to carry out the phase shift of the timing which reads the temporary storage data and drives a pixel positively until all the picture element data is accumulated, After writing in and storing the data of all the pixels in a precedence division colored light generation period, the simultaneous

display (stillness display) of all the pixels is realizable in the next division colored light generation period. In this invention, irrespective of write-in sequential one, such as a dot sequential system or a line sequential color TV system, write-in sequential one can stop by temporary storage sequential, and display simultaneity of a frame change display simultaneous in all the pixels and all the pixels can be realized by pixel drive (data read). Thereby, irrespective of some of pixel numbers of a color picture element generating device, the unevenness of a display screen can be canceled and big-screen-izing or highly minute-ization can be attained by high definition. The merits and demerits of display time and writing time do not conflict in 1 division colored light generation period, but display time can be lengthened about all the pixels as compared with the color picture generating device of the conventional field sequential system. For this reason, in this invention, it has an effect which makes high definition the display image of a color picture generating device. In this invention, since it continues during the division colored light generation and writing operation of all the pixels can be performed, writing time is securable for a long time. In this invention, since low speed-ization of a signal transfer rate can be expected in connection with the ability to lengthen writing time in this way, it has the effect that the simplification or the formation of a high pixel number of peripheral circuit composition is realizable. And there is an advantage that the frame memories for indicative datas which carry out external to the substrate of the electro-optic device which constitutes an image generation part are reducible. In particular, in this invention of such composition, since the pixel drive systems are not an active drive but the static drives based on temporary storage data, there is no attenuation of a pixel driving signal and a perfect digital drive is attained. For this reason, in this invention, the weighting period of the gradation of the color image in the electro-optic device as an image generation part and a division colored light generation period are abbreviated-coincided, And by choosing a division colored light generation period according to the weighting of gradation, and outputting a color image digital signal, it has the effect that it is stabilized and the so-called gradation control of pulse width modulation can be performed.
0032 In this invention, it has a substrate for electro-optic devices with which a picture element electrode was formed in a pixel corresponding to a matrix intersection of a scanning electrode and a signal electrode, respectively, Temporary storage maintenance is carried out shifting color image digital data which arrives at a signal electrode to two or more storage cells which carried out cascade connection one by one for every pixel, A digital memory measure which carries out the static drives of said picture element electrode based on a memory output of said storage cell of a final stage corresponds, respectively, and is made, and a memory output of said storage cell of a final stage, It is preferred to consider it as a color image digital signal corresponding to the subframe period concerned read synchronizing with a division colored light generation period.
0033 According to this invention of such composition, since a storage cell of a final stage always bears, a storage cell which carries out the static drives of the picture element electrode can perform a perfect digital drive. In order to perform color picture generation of a field sequential system, if a storage cell is constituted from two steps, even if it takes into consideration a period of temporary storage operation, and a period of memory output operation, it is enough in time, but three or more steps of storage cells may be provided.
0034 The 1st latch means that incorporates and stores temporarily a color image digital signal which arrives at a signal electrode as the above-mentioned digital memory measure in this invention, The 2nd latch means that read a precedence color image digital signal memorized before one rather than that color image digital signal in this 1st latch means before data incorporation operation of the 1st latch means, and it is stored temporarily, and carries out the static drives of the picture element electrode based on that memory output, Even if small, it is preferred to have composition which it has. Here, the 2nd latch means has the feature in a place which carries out static drives, and the 1st latch means has the feature in a place which functions as a data delay means.
0035 And the 1st data selection means from which the 1st latch means incorporates a color image digital signal, Have the 1st flip-flop that stores temporarily the color image digital signal incorporated by the 1st data selection means, and the 2nd latch means, The

color image digital signal incorporated by the 2nd data selection means that incorporates the output data of the 1st flip-flop, and the 2nd data selection means is stored temporarily, and it has the 2nd flip-flop by which the memory output is electrically connected to said picture element electrode. The 1st flip-flop functions as a delay means, and the 2nd flip-flop functions as a static driving means of a picture element electrode.
0036 As the 1st above-mentioned data selection means, various kinds of composition is employable. For example, the 1st data selection means is 1st MOS transistor for data transfer conducted synchronizing with the 1st timing pulse, The 1st flip-flop is the 1st synchronous method flip-flop that carries out storage operation synchronizing with the 1st timing pulse, The 2nd data selection means is 2nd MOS transistor for data transfer conducted synchronizing with the 2nd timing pulse produced before the 2nd timing pulse, The 2nd flip-flop can be used as the 2nd synchronous method flip-flop that carries out storage operation synchronizing with the 2nd timing pulse. Thus, since a data selection means can be constituted from one transistor, an element number is reducible.
0037 The 1st data selection means is 1st 1 input type gate element that carries out logic operation synchronizing with the 1st timing pulse, The 1st flip-flop is the 1st synchronous method flip-flop that carries out storage operation synchronizing with said 1st timing pulse, The 2nd data selection means is 2nd 1 input type gate element that carries out logic operation synchronizing with the 2nd timing pulse, and the 2nd flip-flop can be used as the 2nd synchronous method flip-flop that carries out storage operation synchronizing with said 2nd timing pulse. When 1 input type gate element is used as a data selection means, two or more transistors are needed, but it is effective in reduction of power consumption, waveform shaping, and energy amplification, and can function as a write-in driving means, and storage operation can be performed certainly. As this 1 input type gate element, a clocked inverter or 3 State buffer may be used, for example.
0038 In the color picture generation method concerning this invention, the good gradation display without brightness lowering can carry out. The means provided by this invention makes time amount sequential generate two or more colored light by a colored light generation part, and it irradiates with it to an image generation part, It is a drive method of the color picture generating device which performs image generation for every colored light by the time sequential corresponding to two or more colored light by an image generation part, Each colored light generation period of two or more colored light within 1 frame period is mutually divided during **two or more** the division colored light generation, and it is an image generation part, and adapted to generate selectively the color image corresponding to a division colored light generation period according to the weighting of gradation.
0039 Since the division colored light generation period which divides the generation period of colored light, and the weighting period of the gradation of the color image in an image generation part are abbreviated-in agreement according to such composition of this invention, the color image in which it continued during the division colored light generation, and the weighting of the gradation was carried out is generable. For this reason, the ratio of the image generation period to a division colored light generation period is high, and luminosity of a display image can be made high. Since **on which a division colored light generation period spreads abbreviation etc. during the weighting of the gradation of a color image** it is set up, it has the effect that the gradation display of a color image can be performed efficiently.
0040 And said division colored light generation period of said colored light of the same color, If it is mutually set as an equal period, according to such composition, it is effective in control with the colored light generating timing of a colored light generation part and the color image generating timing of an image generation part becoming easy, and the composition of the subframe conversion circuit in an image generation part becoming easy.
0041 As for this invention, it is preferred that the division colored light generation period of the colored light of the same color is set as a mutually different period. According to such composition, it has the effect that many gradation numbers are realizable with the number of selections of a division colored light generation period with few each pixel within 1 frame period, by choosing the division colored light generation period according

to the weighting of the gradation of a color image.
0042 It is using the light which includes the wavelength band region of two or more colored light by having composition provided with the rotation light filter in which a colored light generation part's carries out color separation of the light emitted from a light source one by one in time, and generates each of two or more of said colored light in this method, It has the effect that the drive and control by the side of a light source become very easy. In this invention, in order for what is necessary just to be to rotate a rotation light filter with predetermined revolving speed, this also has the effect that the colored light where a drive and control became easy and was stabilized is generable.
0043 In the method concerning this invention, a colored light generation part can be provided with the light source which generates two or more colored light, respectively, and it can have composition which these light sources change and by which they are turned on by time amount sequential. Since two or more colored light is directly generable with a light source if it has such composition, it has an effect which raises the utilization efficiency of colored light.
0044 In the method concerning this invention, a reflection type and a transmission type electro-optic device can be used as an image generation part. As an electro-optic device, it is preferred to use a liquid crystal device. According to this invention of such composition, a good gradation display can be performed, for example in the display device of a direct viewing type, and a projected type display device. A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device in this invention, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a liquid crystal device using the double reflex of liquid crystals, such as a liquid crystal device, OCB, ECB mode, etc. which the cell gap of the TN liquid crystal cell was set up narrowly, and a light scattering type liquid crystal using a polymer dispersed liquid crystal, are applicable. Micro mirror devices, such as a digital micro mirror device (DMD), are applicable as an electro-optic device.
0045 According to this invention of such composition, luminosity of a display image of an electro-optic device of field sequential systems including a liquid crystal device can be made high by leaps and bounds as compared with the former, and it has the effect that a bright color picture is generable.
0046 Since a good gradation display can be performed with high-intensity if the above-mentioned color picture generating device is used for an electronic device, an electronic device provided with a high definition display is realizable.
0047
Mode for carrying out the invention Details of an electronic device hereafter provided with a color picture generating device, a color picture generation method, and a color picture generating device concerning this invention are explained based on an embodiment shown in Drawings.
0048(Embodiment 1) Drawing 1 shows Embodiment 1 of a color picture generating device of a field sequential system concerning this invention by which a digital drive is carried out, and a color picture generation method. As shown in the figure, the color picture generating device 10 of this Embodiment 1, When it is arranged ahead of the light source 11 which emits red light, blue glow, and white light including each spectrum of green light, and this light source 11 and a field of red and a blue and green color element rotates, The rotation light filter 12 in which light from a light source irradiates with a field of each color element, and colored light based on the color element is generated one by one, The condenser 13 arranged ahead of this rotation light filter 12, The reflection type electro-optic device 14 as an image generation part which generates a color image corresponding to a color of colored light which enters via the polarization beam splitter 9, and the condenser 13 and the polarization beam splitter 9, It is the projection type display provided with the projector lens 15 which projects in response to light reflected and modulated with the electro-optic device 14, it is projected so that colored light which received abnormal conditions by image generation from the projector

lens 15 may be overlapped on the screen 16 one by one, and the composite display of the color picture is carried out on the screen 16. The light source 11 is equipped with the reflector 11A which reflects illuminant light as shown in the figure.
0049 Since the polarization selective reflection film is formed along the lamination side of two triangular prisms as for the polarization beam splitter 9, When the light component **on the other hand / (for example, S polarization)** of S polarization which abbreviated-intersects perpendicularly mutually among the entering colored light, and P polarization is reflected and it is reflected with the electro-optic device 14, the rotation degree of a polarization axis is controlled by a liquid crystal for every pixel. This reflected light penetrates the polarization beam splitter 9 again, and enters into the projector lens 15, and the polarization component (for example, P polarization component) of another side penetrates the polarization beam splitter 9, and enters into the projector lens 15. At this time, one polarization component (for example, S polarization component) returns to the light source side. Abnormal conditions are made when the electro-optic device 14 is a liquid crystal light valve, and the light intensity which enters into the projector lens 15 changes according to the grade of rotation of a polarization axis. Since the light from a light source is random polarization, so that most illuminant light may enter into the electro-optic device 14 via a polarization beam splitter, It is preferred to change into one polarization component (for example, S polarization component) the polarization component (for example, P polarization component) of another side included in illuminant light, and to form the polarization converter which arranges illuminant light with one polarization component between a light source and the polarization beam splitter 9.
0050 The rotation light filter 12 rotates so that multiple-times generation of each colored light may be carried out within 1 frame period (the display period of one screen = one vertical scanning period). Even if the rotation in 1 frame period is less than one rotation, as long as it can perform colored light generation of prescribed frequency, less than one revolution may be sufficient, but in this example, it shall rotate one time at 1 frame period. But one or more revolutions may be carried out to 1 frame period, and colored light generation of prescribed frequency may be carried out. Anyway, by the rotation, within 1 frame period, the rotation light filter 12 which constitutes a colored light generation part generates two or more colored light, and defines a colored light generation period. The colored light generation period of each colored light is divided within 1 frame period, respectively, and has a division colored light generation period for every colored light. In this invention, this division colored light generation period is called color subframe period.
0051such a color picture generating device 10 is mainly provided with the microprocessor 17, the timing generator 18, the frame memory 19, the subframe conversion circuit 20, and the drive circuit 21 come out of and constituted. With the timing generator 18, color image generation (drive) timing is synchronized with the color subframe period set up by rotation of the rotation light filter 12 with the reflection type electro-optic device 14, and it controls by this color picture generating device 10.
0052 Next, the outline of operation of this Embodiment 1 is explained. First, it is made to sample in the sampling circuit which does not illustrate image data. And the synchronized signal in an image input signal is sent to the microprocessor 17 and the timing generator 18. Simultaneously with it, the image data in image data is written in the frame memory 19 to the timing controlled by the timing generator 18. The white light emitted from the light source 11 penetrates the rotation light filter 12 of three colors which rotates with the timing generator 18 synchronizing with the driving timing of the electro-optic device 14. Red light, blue glow, and green light are generated one by one from illuminant light by this, and the reflection type electro-optic device 14 glares via the condenser 13 by it. Light modulation is given by the electro-optic device 14, enlargement projection of each colored light irradiated in this way is carried out with the projector lens 15, and image formation is carried out to the screen 16, and it performs a color image display.
0053 The rotation light filter 12 used with the color picture generating device 10 of this Embodiment 1, As shown in drawing 2, it is arranged so that four each of the light filter 12R for red of the sector form where the circle was divided into 12, the light filter 12G for green, and the light filter 12B for blue may repeat the order of R, G, and B, and comes to

be provided in one. In this rotation light filter 12, the light filters 12R, 12G, and 12B of R, G, and B constitute a group in the angle of 90 degrees, and four group (12R1, 12G1, 12B1) - (12R4, 12G4, 12 B4) is arranged on the whole. And in this Embodiment 1, it has set up so that the period which this rotation light filter 12 rotates one time may become the same as that of 1 frame period (1F) of the picture generated with the electro-optic device 14. That is, it is set up rotate one time at 1 frame period (1F). Number of rotations **as opposed to / as stated previously / 1 frame period (1F) of such a rotation light filter 12** , According to the number of the gradation levels and color subframe periods (sf) which are demanded, it is set up suitably, and is not limited to what rotates 1 frame-period (1F) per 1 like this Embodiment 1.

0054 When rotating the rotation light filter 12 one time in this Embodiment 1 at 1 frame period (1F), Time for light from the light source 11 shown in drawing 1 to penetrate one of each of the light filter 12R (1-4), 12G (1-4), and 12B (1-4) which constitutes the rotation light filter 12 turns into a color subframe period (sf). According to this embodiment, each color element of a light filter has made a field width with an angle of 30 degrees which divided 90 degrees the 3rd grade, and since rotational speed is constant, each color subframe period (sf) is a period of the same length. Light of a predetermined wavelength band which a light filter was penetrated during this color subframe period (sf), and absorption and separation were carried out and was generated enters into an image generation field of the electro-optic device 14.

0055 Thus, when n group has a group of a light filter of R, G, and B within 1 frame period (1F), As shown in drawing 3, corresponding to a color subframe period (sf) of each color set up by rotation of the rotation light filter 12, image generation of each color is performed to n times (this Embodiment 1 4 times). In the inside RSF (1-n), GSF (1-n), and BSF of the said figure (1-n), a period in which a drive of a pixel is made according to image data of each colored light currently written in each pixel during the corresponding color subframe is shown for every colored light. Each pixel of the electro-optic device 14 drives each pixel to an ON state or an OFF state with pulse width modulation which modulates colored light with a binary of ON and OFF. Gradation of each colored light is generated for every pixel by changing pulse width of ON and OFF according to image data (picture information). For example, a pixel is driven so that colored light may be penetrated or (in the case of a transmission type electro-optic device) reflected only during the ON (in the case of a reflection type electro-optic device), and according to the length of ON period, colored light is modulated for every pixel.

0056 That is, if it is red light, n pieces' pulse width (time width of ON) of mutually different time length who becomes a weighting period of the gradation in a pulse width gradation system was made to correspond to each period of RSF1 - RSFn, and is distributed and positioned. For example, make the longest pulse width correspond to RSF1, and the period which drives a pixel to the longest time ON state within the period of RSF1 is provided, Long pulse width is made to correspond to the second RSF2, the period which drives long time for a pixel to an ON state within the period of RSF2 the second is provided, and even the pulse width of n pieces and RSFn(s) are similarly assigned to the couple 1. However, even from pulse width short even from long pulse width, even when an order to which pulse width is made to correspond is random, it is not cared about, but one by one, becomes long or tends to perform control by which assigning so that it may become short writes image data in a pixel. Similarly also in other colored light, GSF (1-n) and BSF (1-n) are received, n pieces' pulse width (time width of ON) of mutually different time length who becomes a weighting period of the gradation in pulse width modulation is assigned, and a pixel is driven to an ON state by different time length in each color subframe period.

0057 Thus, during **each** the color subframe (sf). Synchronizing with this, one color image data of ON or OFF beforehand written in according to the weighting of gradation is read in all the pixels in the electro-optic device 14, During **which was assigned during / that / the subframe when each pixel was ON data according to that image data** the weighting, if it is a drive and off-data about a pixel, suppose un-driving that pixel during this subframe period. By this, if n color subframe periods pass, in which color subframe period, by whether it drove based on ON data to the pixel. With the

combination (the number of combination of 2^n) of the pulse width of n pieces from which the weighting period of gradation differs. ON driving period of the pixel in an one-frame term period is decided, the gradation (2^n either of the gradation) of each pixel is formed by that cause, and a picture is generated by all the pixels a drive and by un-driving in each subframe period in this. Since there are the four light filters 12R, 12G, and 12B of each color in this embodiment, respectively as shown in drawing 2, The color picture which the weighting period of the gradation about each colored light becomes four kinds of pulse width, can express $2^4=16$ gradation about each colored light, and is formed of three colors can perform the gradation display of 4096 colors.

0058in addition -- preceding with the color subframe period (sf) the color image data read in a corresponding color subframe period (sf) -- a dot order -- by the next or line sequential, it is alike and is written in all the pixels. However, the writing of image data may be performed to all the pixels for every color subframe, and rewriting of image data may carry out only to a required pixel at each color subframe. The image data needed in each subframe, Since it is a binary of whether a pixel is driven to an ON state in the subframe (ON), or to use an OFF state with a drive (OFF) and rewriting is unnecessary when a front subframe and data do not differ from each other, such control may be performed.

0059 The electro-optic device 14 used by this Embodiment 1, A memory-type liquid crystal device using the liquid crystal which has the bistability of a strong dielectric liquid crystal, an antiferroelectric liquid crystal, etc. as a liquid crystal device of a liquid crystal light valve, for example, A liquid crystal device in pi cell mode, a liquid crystal device using a level orientation type liquid crystal, a liquid crystal device using a perpendicular orientation type liquid crystal, Liquid crystal devices which have high speed response nature, such as a light scattering type liquid crystal using the liquid crystal device using the double reflex of liquid crystals, such as the liquid crystal device and OCB which set up the cell gap of the TN liquid crystal cell narrowly, and ECB mode, a polymer dispersed liquid crystal, etc., are applicable. As an electro-optic device which is not a liquid crystal device, a micro mirror device like DMD which Texas Instruments developed is applicable.

0060 The case of the light scattering type liquid crystal equipment using a polymer dispersed liquid crystal etc., and in the case of a micro mirror device, The polarization beam splitter 9 is unnecessary, and in the case of the former, incident light is modulated by a reflection (in a transmission type, it penetrates), and light scattering, it indicates by gradation, and the latter indicates by gradation by whether it reflects in the projector lens 15, or an absorber is made to absorb by controlling the degree of angle of reflection of the mirror which reflects incident light for every pixel. However, in this case, the incident light and reflected light to an electro-optic device are a relation of a slanting reflection in oblique incidence, and an illumination system and a projection optical system are arranged.

0061 The composition at the time of using a liquid crystal panel as the electro-optic device 14 is explained below. Drawing 14 is a figure showing the section of a liquid crystal panel. As shown in the figure, this electro-optic device 14, For example, the substrate 23 for panels (substrate for electro-optic devices) which adhered with adhesives on the supporting board 22 which consists of glass, ceramics, etc., It has the opposite transparent base 25 by which set the predetermined interval to the substrate 23 for panels, and the placed opposite was carried out to it via the sealant 24 arranged so that the picture element region (viewing area) on this substrate 23 for panels may be surrounded in frame form, It comes to enclose the liquid crystal 26 with the void by which form was carried out by the sealant 24 between the substrate 23 for panels, and the opposite transparent base 25. As described above, as the liquid crystal 26 Well-known TN (TwistedNematic) type liquid crystal, The perpendicular orientation type liquid crystal in which a liquid crystal element carries out abbreviated perpendicular orientation in the state of impressing no voltage, the level orientation type liquid crystal which carries out approximately level orientation without twisting a liquid crystal element in the state of impressing no voltage, and liquid crystals, such as a polymer dispersed liquid crystal, can be used.

0062 The counterelectrode (common electrode) 27 which consists of transparent

conductive materials, such as ITO (indium tin oxide), for example is continued and formed in the opposite inner side side of the opposite transparent base 25 at least at the whole at the viewing area. On the other hand, it arranges and comes to form the picture element electrode 28 at the surface side which the active matrix circuit and the various drive circuits which carry out the postscript of the substrate 23 for panels to a single crystal silicon substrate are made, and counters with said opposite transparent base 25 at matrix form. The picture element electrode 28 is good also as composition which arranges a reflective mirror for the electrode itself to the substrate side separately as a light transmittance state electrode, although the electrode itself is a reflector formed with the electrical conducting material which has light reflex nature. And in each picture element part, it has a means (sample hold circuit) which can store the color image data corresponding to the color subframe period sf as a digital value (H level, L level) so that it may mention later. As shown in drawing 4, the light shielding film 29 which covers unnecessary light incidence is formed in the picture element region (viewing area) periphery of the substrate 23 for panels. While the terminal pad 30 is arranged and formed, the end side of the flexible tape wiring 32 is connected to this terminal pad 30 via the anisotropic conductive adhesives 31 at the periphery of the outside of the sealant 24 in the substrate 23 for panels. The other end side of this flexible tape wiring 32 is connected to the above-mentioned timing generator 18, the frame memory 19, the subframe conversion circuit 20, etc.

0063 In such an electro-optic device 14, by changing effective voltage impressed to the liquid crystal 26 according to image data from the picture element electrode 28, according to change of arrangement of a liquid crystal element in the liquid crystal 26, a plane of polarization and a degree of dispersion of incident light are changed, and it is reflected and emitted. When changing a plane of polarization, incident light is entered via a polarizing element, a reflected light is led to the projector lens 15 via a polarizing element, and light intensity is modulated for every pixel. In change (in the cases **A liquid crystal.** of polymer distributed type etc.) of light scattering, light intensity is modulated for every pixel by providing a slit before the projector lens 15 and passing this.

0064 Next, an operation and operation of each element in the above-mentioned composition are explained. For example, before timing to which light from the light source 11 penetrates a red spectrum region (for example, light filter 12R1) of the rotation light filter 12, According to a read timing signal supplied from the timing generator 18, from the frame memory 19, color image data of a red ingredient made to memorize beforehand in a driving period before this is read one by one, and is outputted to the subframe conversion circuit 20. The subframe conversion circuit 20 which received color image data of this red ingredient, According to a gradation level of color image data of a red ingredient, a weighting period (two or more kinds of pulse width which shows a period which drives a pixel to an ON state) of gradation is set up, Two or more color subframe periods sf arranged within the 1 frame period 1F, a weighting period is made to correspond to the couple 1, and a period is passed -- a **** synchronization being carried out, and, **make and** Prior to a corresponding color subframe period, a color image digital signal (signal of a binary of whether to drive a pixel to an ON state during the pulse width of a weighting of gradation which was able to be formed during **the** the subframe) is supplied to the electro-optic device 14 side to predetermined timing. . In the electro-optic device 14 side, are outputted from the subframe conversion circuit 20. Precedence writing of a color image digital signal with which relating with a color subframe period was performed according to a weighting of gradation is performed, Light from the light source 11 reads data to timing which penetrates a red spectrum region (light filter 12R1) of the rotation light filter 12, It continues in the whole period (R color subframe period 1sf) when red light is generated with the rotation light filter 12 (12R1), and all the pixels are driven to an ON state or an OFF state. Timing control of the timing generator 18 is carried out so that timing of each component may be synchronized in response to control of the microprocessor 17. In the electro-optic device 14, the liquid crystal 26 is driven for every pixel, red light is modulated and reflected, and a picture of red light is generated in connection with this. Therefore, red light by which light intensity

was modulated for every pixel (light intensity of each pixel is determined via a polarizing element when a liquid crystal panel is used) enters into the projector lens 15, and the projection display of the picture of red light is carried out to the screen 16. And a picture of such red light is generated for every color subframe period sf set up correspond by a weighting of gradation within 1 frame period, and a projection display for 1 frame period of a color image is performed. During the color subframe of other colors **one frame of a picture of this red light is generated** of a between, other color images set up corresponding to a weighting of gradation are generated.

0065 Namely, to timing which illuminant light penetrates, green regions (12G1) of the rotation light filter 12. Like a case of red light, image data for green light is read from the frame memory 19, and a predetermined color subframe period (sf) and color image data in which relating was given are outputted according to a weighting of gradation by a subframe conversion circuit. This color image data is inputted and each pixel of that color image data ****** electro-optic device 14 drives by writing of that color image data, and read-out. As a result, green light which enters into the electro-optic device 10 is modulated, and the projection display of the picture of green light is carried out to the screen 16. Timing to which illuminant light penetrates a blue area (for example, 12B1) of the rotation light filter 12 is also the same. Thus, a color image corresponding to colored light generated by time amount sequential with rotation of the rotation light filter 12 will be generated one by one by the electro-optic device 14, and a color picture for one frame will be displayed. Although an order of colored light generation was set as R, G, and B by this true form voice, it may not be limited to this and what kind of order may be sufficient as it.

0066 In the electro-optic device 14 in the color picture generating device 10 of this Embodiment 1. as described above, color image data (digital data) corresponding to a color subframe period (sf) is preceded, and it writes in and has a function which reads color image data corresponding to a corresponding color subframe period -- it has substrate (substrate for electro-optic devices) 23 for panels.

0067 Hereafter, the composition of the substrate 23 for panels of the electro-optic device 14 used for the color picture generating device 10 of this Embodiment 1 is explained.

0068 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit which made drawing 5 to the substrate for panels of the high-reflective-liquid-crystal panel as the electro-optic device 14 in this Embodiment 1 (substrate for electro-optic devices), A timing chart for the circuit diagram and drawing 7 in which the pixel circuit where drawing 6 is contained in it is shown to explain operation of a pixel circuit, and drawing 8 are the timing charts for explaining operation of an active-matrix-liquid-crystal display device drive circuit.

0069 The substrate 23 for high-reflective-liquid-crystal panels used by this Embodiment 1, An active device and a capacitative element are made to the principal surface of a single crystal semiconductor substrate, and an interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.

0070 The active-matrix-liquid-crystal display device drive circuit 50 shown in drawing 5 is provided with the following.

The active matrix circuit 51 made directly under the picture element region of a semiconductor substrate.

The signal line driving circuit (X driver) 52 for sending into signal electrode (X)X1 addressed to one - Xm the color image digital signal (Data) which carries out ingress by serial transfer from the above-mentioned subframe conversion circuit 20 the whole pixel row of the active matrix circuit 51.

The scanning line driving circuit (Y driver) 53 for sending a selection timing signal into the scanning electrode Y1 (Y11-Yn1) addressed to four, Y2 (Y12-Yn2), Y3 (Y13-Yn3), and Y4 (Y14-Yn4) the whole pixel row for choosing the pixel row of the active matrix circuit 51.

The signal line driving circuit 52 and the scanning line driving circuit 53 constitute the peripheral circuit to the active matrix circuit 51.

0071 The insulated gate field effect transistor which is a switch element of n piece multiple connection for the signal line driving circuit 52 to distribute the color image digital signal (Data) of a serial signal to the signal electrode X1 - Xm one by one for every pixel selection period. (it is hereafter called MOSFET.) -- the pixel signal sampling circuit 52a which it has, and the shift clock CLX and the signal wire shift register (X shift register) 52b which generates the switch drive timing pulse phiH1 - phiHm on a target one by one based on latch pulse DX at each switch element are comprised. Have the scanning line driving circuit 53 in the pixel row based on the shift clock CLY and the scanning start pulse (frame start pulse) DY, and the scanning line shift register (Y shift register) 53a which generates the line drive timing pulse phiV1 - phiVn on a target one by one further, The selection timing pulse phi 1 for choosing Ythe scanning electrode Y1 addressed to four, Y2, Y3, or 4 the whole pixel row based on the line drive timing pulse phiV1 - phiVn and liquid crystal AC converted signal (signal which switches for every frame) FR - phi4. It has the selection timing circuit 53b to generate.
0072 In ******** of the matrix intersection part of the signal electrode X in which the active matrix circuit 51 extends in a line direction, and the scanning electrode Y which extends in a line writing direction, the pixel circuit 55 shown in drawing 6 is made. The sample hold circuit 56 where this pixel circuit 55 carries out sample hold of odd number subframe color image digital signal **of color image digital signal V (H level or L level) sent into the signal electrode X** V (O), and the even number subframe color image digital signal V (E) by turns, Odd number subframe color image digital signal V (O) and even number subframe color image digital signal V (E) are read from the sample hold circuit 56 to the degree of a subframe change by turns, and the picture element electrode 28 is consisted of the pixel driving circuit 57 which performs a pixel drive by voltage drive.
0073 The sample hold circuit 56 consists of the 1st sample hold circuit 56a and the 2nd sample hold circuit 56b, and the 1st sample hold circuit 56a, It consists of MOSFET(insulated-gate field-effect transistor) Tof ** 1st1 of N type with the gate G electrically connected to the source S and the 1st scanning electrode Y1 which are electrically connected to the signal electrode X, and the 1st retention volume C1 electrically connected to the drain D. The 2nd MOSFET (T2) of the N type which has the electrically connected gate G in the source S and the 2nd scanning electrode Y2 which the 2nd sample hold circuit 56b is also the same composition, and electrically connect it to the signal electrode X, The 2nd retention volume C2 electrically connected to the drain D is comprised.
0074 The 3rd MOSFET (T3) of the N type with which the pixel driving circuit 57 of this Embodiment 1 has the electrically connected gate G in the source S and the 3rd scanning electrode Y3 which are electrically connected to the 1st retention volume C1, The 4th MOSFET (T4) of the N type which has the gate G electrically connected to the source S and the 4th scanning electrode Y4 which are electrically connected in the 2nd retention volume C2, It consists of the 5th MOSFET (T5) of N type with the source S electrically connected to the drain D and the picture element electrode 28 which are electrically connected to the gate G and the pixel driving source Vdd which electrically connect with the drain D of the 3rd MOSFET (T3) and the 4th MOSFET (T4). The 3rd MOSFET (T3) and 4th MOSFET (T4), Constitute the signal reading means which reads odd number subframe color image digital signal V (O) and even number subframe color image digital signal **from the 2nd retention volume C2** V (E) from the 1st retention volume C1 to the degree of a subframe change by turns, and the 5th MOSFET (T5), The common pixel driving means which impresses the pixel driver voltage Vdd to the picture element electrode 28 according to read odd number subframe color image digital signal V (O) and even number subframe color image digital signal V (E) is constituted.
0075 Although the composition of the selection timing circuit 53b is mentioned later, from the selection timing circuit 53b, the selection timing pulse phi 1 - phi4 which are shown in drawing 7 are generated. In odd number color subframe period 1sf, the 1st write-in timing pulse phi 1 is the 1st scanning electrode Y1. If it generates upwards, The 1st MOSFET (T1) of the 1st sample hold circuit 56a carries out Kaisei, odd number subframe color image digital signal **on the signal electrode X** V (O) is sampled, and the

signal V (O) is written in the 1st retention volume C1. In even number color subframe period 2sf just behind that, the 2nd write-in timing pulse phi 2 is the 2nd scanning electrode Y2. If it generates upwards, The 2nd MOSFET (T2) of the 2nd sample hold circuit 56b carries out Kaisei, even number subframe color image digital signal **on the signal electrode X** V (E) is sampled, and the signal V (E) is written in the 2nd retention volume C2. Odd number subframe color image digital signal V (O) is written in the 1st retention volume C1 of the pixel circuit 55 of all the pixels by point sequential in odd number color subframe period 1sf, Even number subframe color image digital signal V (E) is written in the 2nd retention volume C2 of the pixel circuit 55 of all the pixels by point sequential in even number color subframe period 2sf. A concurrency is carried out to the mutual writing operation for such every color subframe period, odd number color subframe period 1sf is covered, and the 2nd write-in timing pulse phi 4 is the 4th scanning electrode Y4. Since it is continuing generating upwards, Since even number subframe color image digital signal V (E) held by Kaisei of the 4th MOSFET (T4) temporarily at the 2nd retention volume C2 is read, The 5th MOSFET (T5) conducts by even number subframe color image digital signal V (E), and liquid crystal cell LC electrically connected to the picture element electrode 28 drives. Even number color subframe period 2sf is covered, and the 1st write-in timing pulse phi 3 is the 3rd scanning electrode Y3. Since it is continuing generating upwards, Since odd number subframe color image digital signal V (E) held by Kaisei of the 3rd MOSFET (T3) temporarily at the 1st retention volume C1 is read, The 5th MOSFET (T5) conducts by odd number subframe color image digital signal V (O), and liquid crystal cell LC electrically connected to the picture element electrode 28 drives. In a liquid crystal device, liquid crystal cell LC serves as a pixel driven to an ON state or an OFF state via the picture element electrode 28.
0076 Although the write-in system of this Embodiment 1 is a dot sequential system, the write-in sequential one only stops at the sample hold circuit 56, and it does not actualize it as pixel drive sequential. For this reason, a subframe change display simultaneous in all the pixels can be performed, and the unevenness of a display screen can be canceled. It is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized. Since the simultaneous stillness display of all the pixels of a front subframe is realizable between sample hold operations of a back subframe, display time and a write time cannot conflict, but protraction of display time can be realized, and much more high definition-ization can be attained. Since a write period can also be lengthened, the simplification of peripheral circuit composition is realizable.
0077 The selection timing circuit 53b for generating the selection timing pulse phi 1 - phi4 which are shown in drawing 7, In the inverter INV which reverses liquid crystal AC converted signal FR for every color subframe as shown in drawing 5, and each pixel row, Line drive timing pulse phiV (phiV1 - phiVn) from the and (AND) gate A1 and the Y shift register 53a which, on the other hand, considers line drive timing pulse phiV (phiV1 - phiVn) from the Y shift register 53a as an input, and considers liquid crystal AC converted signal FR as an another side input. It consists of the and (AND) gate A2 which considers it as an input on the other hand, and considers an inverter output (FR bar) as an another side input. the output of AND gate A1 -- the 1st scanning electrode Y1 -- supply the output of AND gate A2 to the 2nd scanning electrode Y2, an inverter output (FR bar) is supplied to the 3rd scanning electrode Y3, and AC converted signal FR is supplied to the 4th scanning electrode Y4, respectively. Two AND gates A1 and A2 are equivalent to the scanning electrode selection circuitry which chooses the 1st scanning electrode Y1 and 2nd scanning electrode Y2 by turns for every color subframe period.
0078 According to this Embodiment 1, as described above, the color subframe period (1sf, 2sf -- 12sf) of 12 is contained within the color subframe period 1F specified with the rotation light filter 12. In 1st color subframe period 1sf located in the beginning of the 1 frame period 1F as shown in drawing 8, If liquid crystal AC converted signal FR rises, as shown in drawing 7, the 2nd read-out timing pulse phi 4 will generate, the 4th MOSFET (T4) of each pixel circuit 55 will carry out Kaisei, and the 1st read-out timing pulse phi 3 disappears, and the 3rd MOSFET (T3) closes. In this color subframe period 1sf, the line drive timing pulse phiV1 - phiVn generate on a target one by one from the Y shift register

53a. AND gate A1 of the pixel of the 1st line serves as one with the line drive timing pulse phiV1 generated in the pixel of the 1st line in this color subframe period 1sf, and a high level of liquid crystal AC converted signal FR, The 1st write-in timing pulse phi 1 generates, and the 1st MOSFET (T1) carries out Kaisei. Similarly, whenever the line drive timing pulse phiV2 - phiVn generate the whole horizontal period one by one, the 1st write-in timing pulse phi 1 generates to the pixel row, and the 1st MOSFET (T1) carries out Kaisei.
0079 next, / within the horizontal period which the 1st write-in timing pulse phi 1 of the pixel of the 2nd line generates , Since X shift register 52b generates the switch drive timing pulse phiH1 - phiHm on a target one by one synchronizing with the shift clock CLX, The sampling circuit 52a carries out serial parallel conversion of the color image digital signal (Data) of a serial signal, and the color image digital signals V1-Vm are distributed to the signal electrode X1 for every pixel row - Xm. When the switch drive timing pulse phiH1 occurs, it is the signal electrode X1. The upper color image digital signal V1 is written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the 1st row of the pixel of the 2nd line. Next, when the switch drive timing pulse phiH2 occurs, it is the signal electrode X2. The upper color image digital signal V2 is written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the 2nd row of the pixel of the 2nd line. Finally, if phiHm occurs in a switch drive timing pulse, the color image digital signal Vm on the signal electrode Xm will be written in the 1st retention volume C1 via the 1st MOSFET (T1) of the pixel circuit 55 of the m-th row of the pixel of the 2nd line.
0080 Thus, if color image digital signal **of 1st color subframe period 1sf** V (O) is written in the 1st retention volume C1 of all the pixel circuits 55 by point sequential, In the 2nd next color subframe period 2sf, As shown in drawing 8, liquid crystal AC converted signal FR falls, as shown in drawing 7, the 1st read-out timing pulse phi 3 generates, and the 3rd MOSFET (T3) of each pixel circuit 55 carries out Kaisei, and. The 2nd write-in timing pulse phi 4 disappears, and the 4th MOSFET (T4) closes. For this reason, the pixel signals V1-Vm of each line written in by 1st color subframe period 1sf are read to the 1st retention volume C1 of all the pixel circuits 55 via the 4th MOSFET (T4), According to the pixel signals V1-Vm of each line, the 5th MOSFET (T5) carries out Kaisei, and liquid crystal cell LCs electrically connected to the picture element electrode 28 drive all at once.
0081 As shown in drawing 8, also in this color subframe period 2sf, the line drive timing pulse phiV1 - phiVn generate on a target one by one from the Y shift register 53a. AND gate A2 of the pixel of the 1st line serves as one with the line drive timing pulse phiV1 and H level of an inverter output (FR bar) by which it was generated in the pixel of the 1st line in this color subframe period 2sf, The 2nd write-in timing pulse phi 2 generates, and the 2nd MOSFET (T2) carries out Kaisei, and the 1st MOSFET (T1) closes. Similarly, whenever the line drive timing pulse phiV2 - phiVn generate the whole horizontal period one by one, the 2nd write-in timing pulse phi 2 generates to the pixel row, and the 2nd MOSFET (T2) carries out Kaisei.
0082 In the horizontal period which the 2nd write-in timing pulse phi 2 of the pixel of the 2nd line generates here, Since X shift register 52b generates the switch drive timing pulse phiH1 - phiHm on a target one by one synchronizing with the shift clock CLX, The sampling circuit 52a carries out serial parallel conversion of the color image digital signal (Data) of a serial signal, and the color image digital signals V1-Vm are distributed to the signal electrode X1 for every pixel row - Xm. passing the 2nd MOSFET (T2), as mentioned above since the 2nd MOSFET (T2) of all the pixel circuits 55 of the pixel of the 2nd line is continuing and carrying out Kaisei of each signal electrode X1 - the pixel signals V1-Vm on Xm to the horizontal period -- the 2nd retention volume C2 -- a dot order -- next, it is written in. The pixel signals V1-Vm of each line of this color subframe period 2sf are read all at once in the next odd number color subframe period (3sf), and the simultaneous drive of all the pixels is carried out. Similarly, operation with same color subframe period (4sf) or later is performed.
0083 According to this Embodiment 1, color image generation respectively corresponding to color subframe period 1sf specified with the rotation light filter 12 - 12sf is selectively

performed according to the weighting of gradation. And in each color subframe period sf, since the whole color subframe period sf of the color to which the color image data written in by preceding corresponds is covered and it reads and generates **color image** , the luminosity of the color image generated during the selected color subframe period sf can be improved substantially. The gradation display of a picture can be ensured by choosing the color subframe period sf within the 1 frame period 1F. Although the color subframe period sf within the 1 frame period 1F is an example whose number is even, this Embodiment 1, Since the color image data corresponding to the color subframe period sf can be written in by time amount sequential even if the number of color subframe periods within the 1 frame period 1F is odd, it is convenient in any way.
0084(Embodiment 2) Drawing 9 is a front view showing the rotation light filter used for Embodiment 2 of the color picture generating device concerning this invention, and drawing 10 is a timing chart which shows the timing of the colored light generation and each color image generation in this Embodiment 2. This Embodiment 2 explains only a point which the composition of the rotation light filter 12 differs to the above-mentioned composition of Embodiment 1, and is different. The same mark is given to the above-mentioned Embodiment 1 and identical parts, and the explanation is omitted.
0085 The rotation light filter 120 used with the color picture generating device of this Embodiment 2, The group of the light filter 120R1 of the sector form where angle width is the narrowest as shown in drawing 9 which consists of a group with three angle width, 120G1, and 120B1, The group of the light filter 120R2 of the sector form where angle width is wider than this group's light filter, 120G2, and 120 B-2, It consists of a group of the light filter 120R3 of the largest sector form of angle width, 120 G3, and 120B3, and it is provided in one and becomes so that these may constitute a circle. And it has set up so that the period which this rotation light filter 120 rotates one time may become the same as that of 1 frame period (1F) of the picture generated with the electro-optic device 14 like the Embodiment 1 above-mentioned also in this Embodiment 2. That is, it is set up rotate one time at 1 frame period (1F). The number of rotations to 1 frame period (1F) of such a rotation light filter 120 is suitably set up according to the number of the gradation levels and color subframe periods (sf) which are demanded, and is not limited to what rotates 1 frame-period (1F) per 1.
0086 When rotating the rotation light filter 120 one time in this Embodiment 2 at 1 frame period (1F), Time for light from the light source 11 to penetrate one of each of the light filter 120R (1-3), 120G (1-3), and 120B (1-3) which constitutes the rotation light filter 120 turns into a color subframe period (sf). During **this** the color subframe (sf), the length of time differs among different groups.
0087 And as shown in a timing chart of drawing 10, corresponding to a color subframe period (sf) of each color, image generation of each color is performed to 3 times. In the inside RSF (1-3), GSF (1-3), and BSF of the said figure (1-3), a subframe period by the side of color image generation by which image data read to a corresponding color subframe period is generated is shown. Since it originates in composition of the rotation light filter 120 and the color subframe period sf of three different length is set up in this Embodiment 2, The method of selection of the color subframe period sf that such length differs within 1 frame period in the case of each image generation can perform efficient gray scale representation. In connection with having set up the three length of the color subframe period sf in this way, as for output timing of a color image digital signal, writing timing of a color image digital signal in a picture element part, and read timing, setting out is changed suitably. Other composition in this Embodiment 2 is the same as that of the above-mentioned Embodiment 1. Other operation and effects in this Embodiment 2 are the same as that of the above-mentioned Embodiment 1.
0088 Although the three color subframe periods sf when the length of time differs were set up in this Embodiment 2, the color subframe period when the length of the color subframe period when the length of two time differs, or four time or more differs may be set up. For example, if several n of a color subframe period is 8, the ratio of the length of eight color subframe periods so that it may become either of the n-th power (n is zero or more integers) of 2, respectively, The ratio of the length of a period by making it set to $1(=2^0):2(=2^1):4(=2^2):8(=2^3):16(=2^4):32(=2^5):64(=2^6):128(=2^7)$. The number

Hmax of maximum gradation is realizable 256 times. Namely, the length of each time of two or more color subframe periods which constitute the generation period of each colored light within 1 frame period, If the number of maximum gradation is set to Hmax by setting to CT quota time of the colored light of each color generated within 1 frame period, it will become one which satisfies CT and 2^{m}/Hmax of length. And what is necessary is just to set up the angle width of each light filter of the rotation light filter 120, in order to set up the ratio of such a color subframe period. In this Embodiment 2, although an order within the group of the light filter of identical angle width was uniformly set up in the rotation light filter 120, the light filter in which angle width differs may be set as an unfixed order like the rotation light filter 120A shown, for example in drawing 11. In this example, while being able to perform efficient gray scale representation, it is effective in it becoming possible to make it hard to be conspicuous in the color which is easy to be perceived.

0089(Embodiment 3) Drawing 12 shows Embodiment 3 of a color picture generating device concerning this invention, and a color picture generation method. This Embodiment 3 applies this invention to a color picture generating device of a direct viewing type which equips the display screen front side (drawing 12 upper part) with a lighting system (front light). 3 colored light emitted by color sequential from the front side is generated during the color subframe, and this Embodiment 3 is set up so that timing of color image generation with an electro-optic device as an image generation part may be in agreement during the color subframe of each colored light.

0090 As shown in drawing 12, the electrochromatic display 100 of this Embodiment 3 is provided with the drive circuit 103 which drives and controls the lighting system 101, the electro-optic device 102, and these lighting systems 101 and the electro-optic device 102 of a color change type. In drawing 12, since the lighting system 101 is arranged to the front side, it is considered as a reflection type electro-optic device, and a high-reflective-liquid-crystal display device is used like the above-mentioned Embodiment 1.

0091 The composition of the color change type lighting system 101 is provided with the source 101R of red luminescent light, the source 101G of green luminescent light, the source 101B of blue luminescent light, and the reflector 104 that turns to the display screen of the electro-optic device 102 the colored light emitted from these, and is reflected, for example. These light sources 101R, 101G, and 101B can apply the light source of various kinds of colored light, such as fluorescent tubes, such as a cold cathode tube and a hot cathode tube, EL (electroluminescence) light emitting device, and LED.

0092 Since the composition of the reflection type electro-optic device 102 is the same as the composition explained by Embodiment 1, explanation is omitted.

0093 The drive circuit 103 is provided with the following.

Microprocessor 105.

Timing generator 106.

Frame memory 107.

The subframe conversion circuit 108, the light source color switcher 109, and the power supply 110 for light sources.

The change timing of the light source color switcher 109 and the color image generating timing of the electro-optic device 102 are controlled by this color picture generating device 100 with the timing generator 106. First, it is made to sample in the sampling circuit which does not illustrate image data, and the synchronized signal in an image input signal is sent to the microprocessor 105 and the timing generator 106. Simultaneously with it, the image data in image data is written in the frame memory 107 to the timing controlled by the timing generator 106. The lighting system 101 of a color change type is the light source color switcher 109 controlled by the timing generator 106 so that it may synchronize with the generating timing of each color image of the electro-optic device 102, As for time, the source 101R of red luminescent light, the source 101G of green luminescent light, and the source 101B of blue luminescent light are turned on repeatedly one by one. thus, the lighting system 101 -- the same color order as a foreground-color picture -- next colored light is generated and it is illuminated by the reflection type electro-optic device 102. It is reflected light modulation being given by the electro-optic device 102, and the colored light (light for a display) of each color irradiated

in this way performs a color image display by color sequential.
0094 For example, from the timing generator 106, a light source change timing signal is supplied to the light source color switcher 109, current supply is made from the power supply 110 for light sources to the selected light source, and the red light light source 101R lights up so that the lighting system 101 may emit light in red light. So that it may synchronize with the change timing in this light source color switcher 109, From the timing generator 106, a read timing signal is supplied to the frame memory 107, The image data of the red ingredient made to memorize beforehand in the driving period before this is read one by one, The subframe conversion circuit 108 which receives the image data outputs a color image digital signal to the electro-optic device 102 prior to the corresponding color subframe period set up with the lighting system 101 according to the weighting of the gradation of the color image for red ingredients. In the electro-optic device 102 which receives this color image digital signal, it continues during **that wrote the color-picture-elements digital signal in each picture element part, and synchronized with the corresponding color subframe period / this** the whole color subframe, and the color image for red is generated. Timing control of the timing generator 106 is carried out so that the timing of each component may be synchronized in response to control of the microprocessor 105. In the electro-optic device 102, red light is modulated for every pixel and the picture of red light is generated. Therefore, a picture is displayed on a display screen by the red light by which light intensity was modulated for every pixel.
0095 Next, in the timing which makes the green light light source 101G turn on with the lighting system 101. Like the case of red light, the image data for green light is read from the frame memory 107, relating with a color subframe period is performed according to the weighting of gradation by the subframe conversion circuit 108, and a color image digital signal is outputted to the electro-optic device 102. According to it, by each picture element part of the electro-optic device 102, the color image digital signal is written in prior to a corresponding color subframe period, it reads synchronizing with a corresponding color subframe period, and color image generation is performed. The liquid crystal pinched by this picture element electrode and common electrode in connection with this modulates blue glow, and the pictures of green light are displayed on the color subframe period corresponding to the display screen of the electro-optic device 102 all at once. Next, the timing which the blue glow light source 101B turns on with the lighting system 101 is also the same. Thus, it will be generated by the color subframe period sequential to which the color image of the colored light of three colors corresponds with the electro-optic device 102, and a color picture will be displayed by repeating this cyclically within 1 frame period.
0096 The timing and color image generating timing of colored light generation of the color subframe period sf of this Embodiment 3 are good also as timing as shown in drawing 3 like the above-mentioned Embodiment 1, and, As shown in drawing 10 like the above-mentioned Embodiment 2, the time length of each group's color subframe period sf is good also as timing which synchronizes color image generation with these color subframe periods as mutually different length. And the number of the groups of a color subframe period is not limited. The number of color subframe periods is good also as a number which is different for every color within 1 frame period. The occurrence order of the color of a color subframe period may not be limited in order of R, G, and B, and what kind of order may be sufficient as it.
0097(Embodiment 4) Drawing 13 is a circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels for the electro-optic device (high-reflective-liquid-crystal panel) used with the color picture generating device concerning Embodiment 4 of this invention. According to this Embodiment 4, it is characterized by performing writing and read-out for the color image digital signal which a weighting is carried out and is generated one by one as for time by a picture element part by turns using Y shift register for odd number subframes, and Y shift register for even number subframes. That is, a picture element part is controlled by turns using a Y shift register which is different according to a generation order of two or more color subframe periods sf located in a line by time amount sequential in the odd-numbered

color subframe period and the even-numbered color subframe period within the 1 frame period 1F. This Embodiment 4 is a thing using the high-reflective-liquid-crystal panel of the same composition as the electro-optic device 14 (see drawing 4) in the above-mentioned Embodiment 1, The active-matrix-liquid-crystal display device drive circuit made to the substrate 23 for panels of this electro-optic device 14 (substrate for electro-optic devices) differs from Embodiment 1. The same reference mark is attached and explained to the composition and identical parts of Embodiment 1 in drawing 13.
0098 The substrate 23 for panels of this Embodiment 4 makes an active device and a capacitative element like Embodiment 1 to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0099 The active-matrix-liquid-crystal display device drive circuit 60 of this Embodiment 4 has the same active matrix circuit 51 and signal line driving circuit (X driver) 52 as Embodiment 1. The scanning line driving circuit has somewhat different composition from the thing of Embodiment 1. The whole pixel row The inside of the scanning electrode Y1 addressed to four, Y2, Y3, and Y4, The 3rd scanning electrode Y3 As the 1st upper read-out timing pulse phi 3, liquid crystal AC converted signal (signal which switches for every frame) FR, The 4th scanning electrode Y4 The output (FR bar) of the point used, respectively which reversed liquid crystal AC converted signal FR with the inverter INV as the 2nd upper read-out timing pulse phi 4 is the same as that of Embodiment 1.
0100 However, the composition of the write timing circuit for generating the 1st write-in timing pulse phi 1 supplied to the 1st scanning electrode Y1 and the 2nd write-in timing pulse phi 2 supplied to the 2nd scanning electrode Y2 differs. This write timing circuit, Y shift register 53aa for odd frames which passes 1st write-in timing pulse phi11-phi1n to each pixel row, passes the 1st scanning electrode Y1 to a target one by one, respectively, and is generated during the odd number color subframe based on the shift clock CLY and odd frame start pulse DY1, Based on the shift clock CLY and even-frame start pulse DY2, during the even number color subframe, pass 2nd write-in timing pulse phi21-phi2n to each pixel row, and the 2nd scanning electrode Y2 is passed to a target one by one, respectively. Y shift register 53ab for even frames generated on a target one by one is comprised.
0101 Also in the active-matrix-liquid-crystal display device drive circuit 60 which has such Y shift register 53aa for odd frames, and Y shift register 53ab for even frames, Since the write-in timing pulse phi 1 to each pixel row and generation of phi 2 are unchanging with it of Embodiment 1, the same operation effect as Embodiment 1 can be obtained. In addition, since shift speed by the side of Y is changed the whole field, it is convenient to interpolation processing of an interlace signal, etc.
0102 As mentioned above, although composition and operation of the substrate 23 for panels of the electro-optic device 14 used by this Embodiment 4 were explained, other composition in a color picture generating device of this Embodiment 4 is the same as that of the above-mentioned Embodiment 1, and its operation and effect are the same.
0103(Embodiment 5) A circuit diagram showing an active-matrix-liquid-crystal display device drive circuit which made drawing 14 to a substrate for panels of an electro-optic device (high-reflective-liquid-crystal panel) in a color picture generating device concerning Embodiment 5 of this invention, Drawing 15 is a timing chart explaining operation of the timing circuit. The same reference mark is attached and explained to composition and identical parts of Embodiment 1 in drawing 14.
0104 The substrate for panels of this Embodiment 5 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0105 The active-matrix-liquid-crystal display device drive circuit 70 of this Embodiment 5 has the same active matrix circuit 51 as Embodiment 1, the signal line driving circuit (X

driver) 52, and the Y shift register 53a. In this Embodiment 5, the color subframe period sf of R, G, and B is contained in time sequences at the 1 full frame period 1F.

0106 As a read timing circuit of Embodiment 1, between opening read timing circuit 53ab is provided. In the meantime empty read timing circuit 53ba, The D type flip-flop (FF) which sets to data input D liquid crystal AC converted signal FR' which switches for every color subframe while setting the blanking period setting clock BCK to clocked into CK, And (AND) gate A3 and the NOR (NOR) gate N1 which consider the output Q of the liquid crystal AC converted signal FR' and D type flip-flop (FF) as an input are comprised.

0107 Since a color image digital signal (Data) is transferred serially in order of R color subframe, G color subframe, and B subframe, in the pixel circuit 55. As shown in drawing 15, writing operation of G color subframe is performed at a read-out driving period of R color subframe, Writing operation of B color subframe is performed at a read-out driving period of the following G color subframe, and writing operation of R color subframe is performed at a read-out driving period of the following B color subframe.

0108 Since liquid crystal AC converted signal FR' which carries out a police box to the blanking period setting clock BCK the whole subframe is inputted into a D type flip-flop (FF), Since the output Q of a D type flip-flop (FF) will rise when only blanking period Tb is delayed from a standup point in time of liquid crystal AC converted signal FR' if liquid crystal AC converted signal FR' rises, Output RE2 of the NOR (NOR) gate N1 falls synchronizing with a standup of liquid crystal AC converted signal FR', and output RE1 of AND gate A3 rises synchronizing with a standup of the output Q. Output RE1 is supplied to a gate of the 3rd MOSFET (T3) via the 3rd scanning electrode Y3 as 1st read-out timing pulse phi3 ', Since output RE2 is supplied to a gate of the 4th MOSFET (T4) via the 4th scanning electrode Y4 as 2nd read-out timing pulse phi4 ', Only blanking period Tb vacates from a time of the 4th MOSFET (T4) closing, and the 3rd MOSFET (T3) carries out Kaisei. Therefore, in order that the 4th MOSFET (T4) and 3rd MOSFET (T3) may close simultaneously at the time of a frame period change, mixture of B signal and R signal does not take place, and additive color mixture at the time of a hue lighting-system change is not gathered.

0109 Since the output Q of a D type flip-flop (FF) will fall when only blanking period Tb is delayed from the falling point in time of liquid crystal AC converted signal FR' if liquid crystal AC converted signal FR' falls, Output RE1 of AND gate A3 falls synchronizing with falling of liquid crystal AC converted signal FR', and output RE2 of NOR gate N1 rises synchronizing with falling of the output Q. For this reason, only blanking period Tb vacates from the time of the 3rd MOSFET (T3) closing, and the 4th MOSFET (T4) carries out Kaisei. Therefore, in order that the 4th MOSFET (T4) and 3rd MOSFET (T3) may carry out simultaneous closing at the time of a subframe change, mixture of R signal and G signal does not take place, and additive color mixture at the time of a hue lighting-system change is not gathered. Similarly, mixture of G signal and B signal does not take place, and additive color mixture at the time of a hue light source change is not gathered.

0110 Thus, in order that blanking period Tb may be vacated and the 4th MOSFET (T4) and 3rd MOSFET (T3) may open and close exclusively in this Embodiment 5, Since both do not penetrate and additive color mixture at the time not only of mixture of holding signals not occurring but a hue lighting-system change is not gathered, a high-definition colored presentation can be performed. Thus, it becomes possible to perform good color picture generation especially in a color sequential field sequential system by adding between opening read timing circuit 53ab to composition. Mixture of the holding signals at the time of a frame change can be prevented by losing certainly simultaneous Kaisei of the 4th MOSFET (T4) and the 3rd MOSFET (T3) at the time of a frame change.

0111 Since other composition in this Embodiment 5 is the same as that of the above-mentioned Embodiment 1, it can do so same operation and the effect as Embodiment 1.

0112(Embodiment 6) The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit 80 which made drawing 16 to the substrate for panels of the electro-optic device in the color picture generating device concerning Embodiment 6 of this invention, Drawing 17 (A) is a timing chart for the circuit diagram and drawing 17 (B) in which the pixel circuit is shown to explain operation of the pixel circuit. In drawing

16, the same reference mark is given to the composition and identical parts of Embodiment 1, and the explanation is omitted.
0113 The substrate for panels of this Embodiment 6 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0114 The active-matrix-liquid-crystal display device drive circuit 80 of this Embodiment 6 is provided with the signal line driving circuit (X driver) 52 and the Y shift register 53a like Embodiment 1 shown in drawing 5, and the composition of the pixel circuit 82 of the active matrix circuit 81 differs in the pixel circuit 55 of Embodiment 1. The sample hold circuit 83 which carries out the sample hold of the even number color subframe signal V (E) to odd number color subframe signal **of color image digital signal V sent into the signal electrode X** V (O) by turns as the pixel circuit 82 of this Embodiment 6 is shown in drawing 17 (A), The pixel driving circuit 84 which reads odd number color subframe signal V (O) and the even number color subframe signal V (E) from the sample hold circuit 83 by turns the whole frame, carries out the voltage drive of the picture element electrode 28, and performs a pixel drive is comprised.
0115 The sample hold circuit 83 consists of the 1st sample hold circuit 83a and the 2nd sample hold circuit 83b, and the 1st sample hold circuit 83a, It consists of the 1st MOSFET (Q1) of N type with the gate G electrically connected to the source S and the 1st scanning electrode Y1 which are electrically connected to the signal electrode X, and the 1st retention volume C1 electrically connected to the drain D. The 2nd MOSFET (Q2) of the P type which has the electrically connected gate G in the source S and the 2nd scanning electrode Y2 which the 2nd sample hold circuit 83b is also the same composition, and electrically connect it to the signal electrode X, It consists of the 2nd retention volume C2 electrically connected to the drain D. The 1st MOSFET (Q1) and 2nd MOSFET (Q2) serve as a reverse conductivity type, and constitute what is called CMOS. For this reason, the 1st write-in TAIN ming pulse phi 1 for the 1st MOSFET (Q1) a standup pulse, Since the 2nd write-in TAIN ming pulse phi 2 for the 2nd MOSFET (Q2) needs the falling pulse, The 2nd scanning electrode Y2 of the selection timing circuit 53b which showed drawing 5 write-in TAIN ming circuit 53b' of this Embodiment 6 AND gate A2 of ** is replaced with NAND gate N2.
0116 On the other hand, the 3rd MOSFET (Q3) of the P type with which the pixel driving circuit 84 has the electrically connected gate G in the source S and the 3rd scanning electrode Y3 which are electrically connected to the 1st retention volume C1, The 4th MOSFET (Q4) of the N type which has the gate G electrically connected to the source S and the 3rd scanning electrode Y3 which are electrically connected in the 2nd retention volume C2, It consists of the 5th MOSFET (Q5) of N type with the source S electrically connected to the drain D and the signal electrode 14 which are electrically connected to the gate G and the pixel driving source Vdd which electrically connect with the drain D of the 3rd MOSFET (Q3) and the 4th MOSFET (Q4). With the 3rd MOSFET (Q3) and the 4th MOSFET (Q4), it is a reverse conductivity type and what is called CMOS is constituted. In order to open and close the 3rd MOSFET (Q3) and 4th MOSFET (Q4) exclusively with like-pole nature gate voltage, the common read-out timing pulse phi 3 is supplied to both the gates G via the 3rd only scanning electrode Y3. Therefore, one number of the scanning electrode addressed to a pixel row is reducible.
0117 In this Embodiment 6, the comparatively high voltage from which the counterelectrode (common electrode; LC.COM) 27 by the side of the opposite transparent base 25 which is made to counter the substrate 23 for panels and is assembled switches for every frame is impressed.
0118 For this reason, since the potential of counterelectrode LC.COM is straight polarity in odd number color subframe period 1sf as shown in drawing 17 (B), when the 4th MOSFET (Q4) carries out Kaisei, a holding signal is read and the 5th MOSFET (Q5) carries out Kaisei, the potential difference of the signal electrode potential (power supply potential Vdd) by the side of an anode and the potential of counterelectrode LC.COM by

the side of a cathode has the relatively considerable power supply potential Vdd also at low pressure -- it is large. Since the potential of counterelectrode LC.COM becomes negative polarity in even number color subframe period 2sf, when the 3rd MOSFET (Q3) carries out Kaisei, a holding signal is read and the 5th MOSFET (Q5) carries out Kaisei, the potential difference of the signal electrode potential by the side of a cathode and the potential of counterelectrode LC.COM by the side of an anode is also relatively considerable -- it is large.

0119 Thus, by performing what is called a common way that carries out the police box of the potential of counterelectrode (common electrode) LC.COM for every subframe, Since the dynamic range of a signal impressed to the picture element electrode 28 not to mention the ability to prevent degradation of liquid crystal cell LC can be relatively made small, formation becomes possible by using MOSFET of the pixel circuit 82 as a low resisting pressure element. Thereby, an element miniaturization can realize reduction of an occupation area and increase of a numerical aperture can realize high-density high definition display equipment.

0120 As mentioned above, although composition of the substrate 23 for panels of the electro-optic device 14 of this Embodiment 6 was explained, other composition in this Embodiment 6 is the same as that of the above-mentioned Embodiment 1, and does so same operation and the effect as Embodiment 1.

0121(Embodiment 7) Drawing 18 is a circuit diagram showing an active-matrix-liquid-crystal display device drive circuit made to a substrate for panels of an electro-optic device in a color picture generating device concerning Embodiment 7 of this invention. In drawing 18, the same reference mark is given to composition and identical parts of Embodiment 4 and Embodiment 6, and the explanation is omitted.

0122A substrate for these embodiment 7 panels also makes an active device and a capacitative element to a principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of a rectangle of a large number arranged by matrix form in a picture element region which occupies an active area superficially.

0123 The active-matrix-liquid-crystal display device drive circuit 85 of this Embodiment 7, Like Embodiment 4 shown in drawing 13, the signal line driving circuit (X driver) 52, Y shift register 53aa for odd frames, It has the active matrix circuit 81 with the pixel circuit 82 like Embodiment 6 which is provided with Y shift register 53ab for even frames, and is shown in drawing 16 and drawing 17. Therefore, this Embodiment 7 does so same operation and the effect as Embodiment 4 and Embodiment 6.

0124 As mentioned above, although Embodiment 1 of the color picture generating device concerning this invention and a color picture generation method - Embodiment 7 were described, Although the substrate for panels makes a switching element from these embodiments to the principal surface of a semiconductor substrate, not only as a semiconductor substrate but as a substrate, insulating substrates, such as a glass substrate and a quartz substrate, can be used. Even when forming a thin film transistor (TFT) etc. on an insulating substrate as a switching element, it cannot be overemphasized that this invention is applicable. In these Embodiments 1 - Embodiment 7, write-in sequential ones does not turn into pixel drive sequential simultaneously irrespective of a dot sequential system or a line sequential color TV system, Since it only stops at temporary storage sequential, and write-in sequential one is not actualized as pixel drive sequential but a change display simultaneous in all the pixels can do the color image corresponding to each color subframe period, the unevenness of a display screen can be canceled and the good high-definition color picture generating device of gray scale representation can be provided. Since a change display simultaneous in this way can be performed, it is unrelated to some of pixel numbers, and high-definition big-screen-izing or highly-minute-izing can be realized.

0125 Although these Embodiments 1 - Embodiment 7 were the composition provided with what is called a capacitor memory of making the retention volume C1 and C2 memorizing the writing of a color image digital signal, they can also be considered as the composition which makes static memory for every pixel and makes a digital value

memorize. Embodiment 8 and Embodiment 9 which are described below are the example which made static memory for every pixel.
0126(Embodiment 8) The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit which made drawing 19 to the substrate for panels in Embodiment 8 of the color picture generating device concerning this invention, The circuit diagram showing the digital store circuit which drawing 20 (A) provides for every pixel of an active-matrix-liquid-crystal display device drive circuit, The timing chart drawing 20 (B) explains operation of the digital store circuit to be, and drawing 21 are the timing charts explaining overall operation of an active-matrix-liquid-crystal display device drive circuit.
0127 The substrate for panels of this Embodiment 8 also makes an active device and a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially.
0128 The active-matrix-liquid-crystal display device drive circuit 90 shown in drawing 19 is provided with the following.
The matrix circuit 91 made directly under the picture element region (viewing area) of a semiconductor substrate.
The shift register 92 for serial parallel conversion (a signal electrode driving circuit, X driver) for sending into signal electrode (X)X_0 - X_m addressed to one the color image digital signal (DATA) which carries out ingress by serial transfer by line sequential the whole pixel row of the matrix circuit 91.
the digital store circuit M for every pixel of the matrix circuit 91 (M_{00} - M_{nm}) -- order of rows -- the next -- a latch control signal (writing timing signal) -- the scanning electrode Y addressed to pixel row 2, $_1$ **and (Y_{10} - Y_{1n})** The scanning electrode driving circuit (Y driver) 93 for sending in via Y_2 (Y_{20} - Y_{2n}).
The 2nd timing pulse for carrying out the simultaneous drive of all the picture element electrodes 28 (it read-out-clock-pulse-RCK(s) (phi 3), and a non-inverter) Scanning electrode Y_3 addressed to every pixel row 2 (Y_{30} - Y_{3n}) which transmits the read-out clock pulse RCK bar (phi 4) of an opposite phase, Y_4 (Y_{40} - Y_{4n}).
The shift register 92 for serial parallel conversion and the scanning electrode driving circuit 93 constitute the peripheral circuit to the matrix circuit 91 of a central picture element region here.
0129 The shift register 92 for serial parallel conversion carries out shift transmission of the color image digital signal (DATA=D_0 - D_m) of a serial sequence synchronizing with the shift clock CLX, and makes a color image digital signal corresponding to signal electrode X_0 - X_m top appear for every horizontal period. The scanning electrode driving circuit 93, The scanning electrode shift register (Y shift register) 93a which carries out shift transmission of the scanning start pulse (frame start pulse) DY synchronizing with the shift clock CLY, and generates line drive timing pulse phi_0 - phi_n on a target one by one on a pixel row for every vertical period, It consists of the latch timing circuit 93b which writes in with line drive timing pulse phi_0 - phi_n, and generates the 1st timing pulse (the latch control pulse phi 1 of a non-inverter, the latch control pulse phi 2 of an opposite phase) on the scanning electrode Y1 and Y2 based on the clock pulse WCK, respectively.
0130 While writing in this latch timing circuit 93b with line drive timing pulse phi_0 corresponding in each pixel row - phi_n and outputting a logical product with the clock pulse WCK on 1st scanning electrode Y_1 as the latch control pulse phi 1 of a non-inverter, They are logic circuit G_0 which outputs an inverted output of the logical product output phi 1 on 2nd scanning electrode Y_2 as the latch control pulse phi 2 of an opposite phase - G_n.
0131 In each of the matrix intersection part of the signal electrode X which extends in a line direction, and the scanning electrode Y which extends in a line writing direction, the digital store circuit M (M_{00} - M_{nm}) shown in drawing 20 (A) is made by the matrix circuit 91. Each of this digital store circuit M is provided with the following.
It has the memory output Q which impresses driver voltage to the picture element

electrode 28 which counters with data input D and the common electrode 27 which the arrival ******** digital signal Di inputs into the signal electrode Xi, and pinches the liquid crystal 26, The 1st latch circuitry L1 that incorporates and stores temporarily the color image digital signal Di which arrives at the signal electrode Xi in the precedence color subframe period (it is the odd-numbered color subframe period for example, within 1 frame period) sf.
The 2nd latch circuitry L2 outputted to the memory output Q while reading the color image digital signal Di stored temporarily in the 1st latch circuitry L1 in the lagging color subframe period (even-numbered color subframe period) sf before the latch operation of the 1st latch circuitry L1 and storing it temporarily.

0132 The 1st latch circuitry L1 is provided with the following.
1st N channel type MOSFET for data transfer that incorporates a color image digital signal synchronizing with the latch control pulse phi 1 of the non-inverter of 1st scanning electrode Y_{i1} (T1).
1st synchronous method flip-flop F1 that carries out temporary storage operation of the data which passed 1st MOSFET for data transfer (T1) synchronizing with disappearance of the latch control pulse phi 2 of the opposite phase on 2nd scanning electrode Y_{i2}.
The 2nd latch circuitry L2 is provided with the following.
2nd N channel type MOSFET for data transfer that incorporates the output data of 1st synchronous method flip-flop F1 synchronizing with the read-out clock pulse RCK (phi 3) of the non-inverter on 3rd scanning electrode Y_{i3} (T2).
The 2nd synchronous method flip-flop F2 that carries out temporary storage operation synchronizing with disappearance of the latch control pulse phi 4 of the opposite phase on 4th scanning electrode Y_{i4}, and outputs the data which passed 2nd MOSFET for data transfer (T2) to the memory output Q.

01331st synchronous method flip-flop F1 is provided with the following.
The two inverter INV1 and 1st double inverting circuit that made round connection of INV2.
1st N channel type MOSFET for hold-stores control that separates temporarily the electrical link of the input of the first rank INV1, and the output of return stage INV2 synchronizing with the latch control pulse phi 2 of an opposite phase (Q1).
2nd synchronous method flip-flop F1 is provided with the following.
The 2nd double inverting circuit that made round connection of two inverter INV3 and INV4.
2nd MOSFET for hold-stores control that separates temporarily the electrical link of the input of the first rank inverter INV3, and the output of return stage inverter INV4 synchronizing with the read-out timing pulse phi 4 of an opposite phase (Q2).

0134 In **as shown in the timing chart of drawing 21** 1st color subframe period 1sf, If liquid crystal AC converted signal FR which switches for every subframe rises, while the read-out timing pulse RCK (phi 3) of a non-inverter will generate on 3rd scanning electrode Y_{30} - Y_{3n} synchronizing with the standup, The read-out timing pulse RCK (phi 4) of an opposite phase generates on 4th scanning electrode Y_{40} - Y_{4n}. The scanning start pulse DY is added to the scanning electrode shift register 93a at the same time AC converted signal FR rises, While line drive timing pulse phi_0 - phi_n generate on a target one by one synchronizing with the shift clock CLY produced in a constant interval, the write-in clock pulse WCK occurs and occurs synchronizing with the shift clock CLY. For this reason, while latch control pulse phi1 $_0$ of a non-inverter - phi1 $_n$ (phi 1) generate on 1st scanning electrode Y_{10} of a pixel row - Y_{1n}, On 2nd scanning electrode Y_{20} - Y_{2n}, latch control pulse phi2 $_0$ of an opposite phase - phi2 $_n$ (phi 2) generate.
0135the **therefore, / the 1st -** -- the pulses phi1-phi4 are generated by scanning electrode Y_{i1} of four - Y_{i4} in an order shown in drawing 20 (B). If the latch control pulses phi1 and phi2 occur on 1st scanning electrode Y_{i1} and 2nd scanning electrode Y_{i2} during the write-in period W1 of a precedence color subframe period (for example, 1sf), In 1st synchronous method flip-flop F1, while one **1st MOSFET for data transfer (T1)** , Since

1st MOSFET for hold-stores control (Q1) turns off, the output of return stage inverter INV2 does not return to first rank inverter INV1, The logical value of the lead data D1 from 1st MOSFET for data transfer (T1) is impressed by first rank inverter INV1, and the reversal logical value appears in the output of first rank inverter INV1. After the latch control pulses phi1 and phi2 disappear and write in and the period W1 expires, while 1st MOSFET for data transfer (T1) turns off, Since one **1st MOSFET for hold-stores control (Q1)** , the output of return stage inverter INV2 returns to first rank inverter INV1, and the storage operation of 1st synchronous method flip-flop F1 re-functions, The reversal logical value of the lead data (color image digital signal) D1 is stored temporarily at 1st synchronous method flip-flop F1.
0136 If it reads on 3rd scanning electrode Y_{i3} and 4th scanning electrode Y_{i4} in the read-out period R1 of the next lagging color subframe period (for example, 2sf) and the clock pulses phi3 and phi4 occur, In the 2nd synchronous method flip-flop F2, while one **2nd MOSFET for data transfer (T2)** , Since 2nd MOSFET for hold-stores control (Q2) turns off, the output of return stage inverter INV4 does not return to first rank inverter INV3, The reversal logical value of the lead data D1 from 1st synchronous method flip-flop F1 is impressed by first rank inverter INV3, and the reversal logical value (lead data D1) appears in the output of first rank inverter INV3. After the read-out clock pulses phi3 and phi4 disappear and read and the period W1 expires, while 2nd MOSFET for data transfer (T2) turns off, Since one **2nd MOSFET for hold-stores control (Q2)** , the output of return stage inverter INV4 returns to first rank inverter INV3, and the storage operation of the 2nd synchronous method flip-flop F2 re-functions, While the lead data D1 is stored temporarily at the 2nd synchronous method flip-flop F2, the memory output Q continues being supplied to the picture element electrode 28. Then, if the latch control pulse phi 1 and 2 occur on 1st scanning electrode Y_{i1} and 2nd scanning electrode Y_{i2} during the write-in period W2, the memory content of 1st synchronous method flip-flop F1 will be rewritten by the lagging data D2 like the order mentioned above.
0137 Although a writing system of this Embodiment 8 is a line sequential color TV system, the write-in sequential one only stops at 1st synchronous method flip-flop F1, the 2nd synchronous method flip-flop F2 writes in, and sequential does not spread. For this reason, a subframe change display simultaneous in all the pixels can be performed in each color subframe period sf, and unevenness of a display screen can be canceled. Since a simultaneous stillness display of all the pixels of a front color subframe can be realized between writing operation of a back color subframe, it can moreover continue during the whole color subframe and a color image can be displayed, High definition-ization can be attained, while display time and writing time do not conflict within 1 frame period but raise luminosity.
0138 In this Embodiment 8, the 2nd flip-flop F2 is functioning as a driver who carries out the static drives of the picture element electrode 28. Unlike an active matrix driven, there is no attenuation of a pixel driving signal and a perfect digital drive is attained.
0139the 1st and 2nd above-mentioned MOSFET for data transfer (T1, T2) -- mutual -- turning on and off exclusively -- both 1st and 2nd MOSFET(Q1, Q2) MO for hold-stores control, although it turns on and off exclusively, By using mutually the 1st and 2nd MOSFET for data transfer (T1, T2) as a reverse conductivity type, and using mutually 1st and 2nd MOSFET for hold-stores control (Q1, Q2) as a reverse conductivity type, It is not necessary to send both sides of a non-inverter pulse and an opposite phase pulse to the digital store circuit M, and scanning electrodes can be reduced two.
0140 As mentioned above, although the substrate for panels of the electro-optic device used with the color picture generating device of Embodiment 8 was explained, other composition and effects in this Embodiment 8 are the same as that of the above-mentioned Embodiment 1.
0141(Embodiment 9) Drawing 22 is a circuit diagram showing the digital store circuit made to the substrate for panels of the electro-optic device in Embodiment 9 of the color picture generating device concerning this invention (substrate for electro-optic devices). In drawing 22, the same mark is given to the composition and identical parts of Embodiment 8, and the explanation is omitted.
0142 The substrate 23 for panels in this Embodiment 9 also makes an active device and

a capacitative element to the principal surface of a single crystal semiconductor substrate (for example, 20 mm squares), An interlayer insulation film and a conductive layer are accumulated by turns on it, membranes are formed, and it has the picture element electrode (reflector) 28 of the rectangle of a large number arranged by matrix form in the picture element region which occupies an active area superficially. Although it has the same shift register 92 for serial parallel conversion and scanning electrode driving circuit 93 as the above-mentioned Embodiment 8 which also described this Embodiment 9 above, the composition of digital store circuit M' differs from the digital store circuit M of Embodiment 8.

0143 Digital store circuit M' is provided with the following.
It has the memory output Q which impresses driver voltage to the picture element electrode 28 which pinches the liquid crystal 26 on data input D which the color image digital signal Di which arrives at the signal electrode Xi inputs like the digital store circuit M, and the common electrode 27, The 1st latch circuitry L1' that incorporates and stores temporarily the color image digital signal Di which arrives at the signal electrode Xi in a precedence color subframe period (for example, odd number color subframe period).
The 2nd latch circuitry L2' outputted to the memory output Q while reading the color image digital signal Di stored temporarily in 1st latch circuitry L1' in a lagging color subframe period (for example, even number color frame period) before latch operation of 1st latch circuitry L1' and storing it temporarily.

01441st latch circuitry L1' is provided with the following.
The 1st clocked inverter K1 that considers the color image digital signal Di as an input, and carries out logic operation synchronizing with the latch control pulse phi 1 of a non-inverter of 1st scanning electrode Y_{i1}.
1st synchronous method flip-flop F1' that carries out temporary storage operation of the output data synchronizing with disappearance of the latch control pulse phi 2 of an opposite phase on 2nd scanning electrode Y_{i2}.
2nd latch circuitry L2' is provided with the following.
The clocked inverter K2 which considers output data of 1st synchronous method flip-flop F1' as an input, and carries out logic operation synchronizing with the read-out clock pulse RCK (phi 3) of a non-inverter on 3rd scanning electrode Y_{i3}.
2nd synchronous method flip-flop F2' that carries out temporary storage operation synchronizing with disappearance of a read-out clock pulse RCK bar (phi 4) of an opposite phase on 4th scanning electrode Y_{i4}, and outputs the output data to the memory output Q.

01451st synchronous method flip-flop F1' is the two inverter INV1 and 1st double inverting circuit that made round connection of INV2', The return stage inverter INV2' is a clocked inverter which interrupts logic operation synchronizing with the latch control pulse phi 2 of an opposite phase, 2nd synchronous method flip-flop F2' is also the two inverter INV3 and 2nd double inverting circuit that made round connection of inverter INV4', and is a clocked inverter for which the return stage INV4' interrupts logic operation synchronizing with the read-out clock pulse phi 4 of an opposite phase.

0146 If the latch control pulses phi1 and phi2 occur on the 1st scanning electrode Yi1 and 2nd scanning electrode Yi2 during the write-in period W1 of a precedence color subframe period (for example, 1sf) as this Embodiment 9 is shown in drawing 20 (B), In 1st synchronous method flip-flop F1', while the 1st clocked inverter K1 carries out logic operation, In order that return stage inverter INV2' may interrupt logic operation, an output of return stage inverter INV2' does not return to first rank inverter INV1, A logical value of the precedence color image digital signal D1 from the 1st clocked inverter K1 is impressed by inverter INV1 of the first rank, and the logical value appears in an output of first rank inverter INV1. After the latch control pulses phi1 and phi2 disappear and write in and the period W1 expires, while the 1st clocked inverter K1 interrupts logic operation, In order that return stage inverter INV2' may carry out logic operation, an output of return stage inverter INV2' returns to first rank inverter INV1, and storage operation of 1st synchronous method flip-flop F1' re-functions, The precedence color image digital

signal D1 is stored temporarily at 1st synchronous method flip-flop F1'.
0147 In **if it reads on the 3rd scanning electrode Yi3 and 4th scanning electrode Yi4 in the read-out period R1 of the next lagging color subframe period (for example, 2sf) and the clock pulses phi3 and phi4 occur** 2nd synchronous method flip-flop F2', While the 2nd clocked inverter K2 carries out logic operation, in order that return stage inverter INV4' may interrupt logic operation, The output of return stage inverter INV4' does not return to first rank inverter INV3, The reversal logical value of the precedence color image digital signal D1 from 1st synchronous method flip-flop F1' is impressed by first rank inverter INV3, and the reversal logical value (precedence color image digital signal D1) appears in the output of first rank inverter INV3. After the read-out clock pulses phi3 and phi4 disappear and read and the period R1 expires, while the 2nd clocked inverter K1 interrupts logical-value operation, In order that return stage inverter INV4' may carry out logic operation, the output of return stage inverter INV4' returns to first rank inverter INV4, and the storage operation of 2nd synchronous method flip-flop F2' re-functions, While the precedence color image digital signal D1 is stored temporarily at 2nd synchronous method flip-flop F2', the memory output Q continues being supplied to the picture element electrode 28. Then, if the latch control pulses phi1 and phi2 occur on the 1st scanning electrode Yi1 and 2nd scanning electrode Yi2 during the write-in period W2, the memory content of 1st synchronous method flip-flop F1' will be rewritten by the lagging color image digital data D2 like the order mentioned above.
0148 As mentioned above, although a substrate for panels of an electro-optic device of a color picture generating device of this Embodiment 9 was explained, other composition in this Embodiment 9 is the same as that of above-mentioned Embodiment 1 and Embodiment 8, and does same operation effect so.
0149 In this Embodiment 9, by digital store circuit M', since a clocked inverter is used, it is effective in reduction of power consumption, waveform shaping, and energy amplification, and can contribute to certain-ization of storage operation. It is also possible to use 3 State buffer instead of clocked inverter K1 and K2.
0150 As mentioned above, although Embodiment 1 - Embodiment 9 were described, a color picture generating device of these embodiments is applicable to various kinds of electronic devices, such as a liquid crystal projector, a word processor, and a personal computer, for example. Various kinds of change which is not limited to the above-mentioned Embodiment 1 - Embodiment 9, and accompanies a summary of composition is possible for this invention. For example, in the above-mentioned Embodiment 1 - Embodiment 9, although a reflection type liquid crystal panel was applied as an electro-optic device, DMD (digital micro mirror device) may be applied. DMD modulates light volume which makes the degree of angle of inclination of a reflective mirror change according to a color image digital signal for every pixel, and enters into a projector lens. According to color image data, Pulse Density Modulation (PWM) of time width which more specifically turns to a projector lens light reflected by reflective mirror, and the time width which makes an absorber absorb light reflected is carried out, and it enables it to modulate intensity of colored light for every pixel. And color image digital data provided in a substrate for panels (substrate for electro-optic devices) which was used by an embodiment which a reflective mirror described above to a substrate arranged at matrix form, a means (a thing provided with a capacitor memory which was described above.) which read said data to a correspondence color subframe period all at once while memorizing prior to a corresponding color subframe period By making a thing provided with static memory build in, the angle changing drive of the reflective mirrors of each pixel can be carried out to a color subframe period all at once.
0151 In the above-mentioned Embodiment 1 - Embodiment 9, although the reflection type liquid crystal panel was applied as an electro-optic device, colored light is made to penetrate using a transmission type electro-optic device like a transmission type liquid crystal panel, and light intensity may be modulated. In the case of a liquid crystal panel, polarizing elements, such as a polarizing plate, are required at least at one side by the side of colored light incidence of a panel, and outgoing radiation (unnecessary in the case of a light scattering type liquid crystal). Namely, although this invention has been explained by making a reflection type electro-optic device into a subject in each

embodiment, The color image display device and the method of presentation of a field sequential system of this invention which can be been and set, May constitute as a projection type display which carries out the projection display of the light modulated by penetrating a transmission type electro-optic device to a screen, and, The lighting system 101 shown in drawing 12 at the back side may be arranged, the colored light from there may be modulated with a transmission type electro-optic device, and it may constitute as a display device which faces the transmitted light squarely.

0152 It cannot be overemphasized that this invention is not limited to the number of partitions of length setting out of the above-mentioned color subframe period of each embodiment and the color generation period within 1 frame period, and it can change suitably according to the gradation level of a color image.

0153 Although 3 colored light of red light, green light, and blue glow made into colored light explained in the above-mentioned embodiment, 3 colored light of cyanogen light, magenta light, and yellow light may be sufficient, and more colored light than two-color light and 3 colored light can also be used.

Brief Description of the Drawings

Drawing 1 The composition explanatory view showing Embodiment 1 of the color picture generating device concerning this invention.

Drawing 2 The front view of the rotation light filter used for Embodiment 1.

Drawing 3 The timing chart which shows the color generating timing and color image generating timing in Embodiment 1.

Drawing 4 The sectional view of the electro-optic device in Embodiment 1.

Drawing 5 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for electro-optic devices of the electro-optic device in Embodiment 1.

Drawing 6 The circuit diagram showing the pixel circuit in Embodiment 1.

Drawing 7 The timing chart for explaining operation of the pixel circuit in Embodiment 1.

Drawing 8 The timing chart for explaining operation of the pixel circuit in Embodiment 1.

Drawing 9 The front view showing the rotation light filter used for Embodiment 2 of the color picture generating device concerning this invention.

Drawing 10 The timing chart which shows the timing of the colored light generation and each color image generation in this Embodiment 2.

Drawing 11 The front view showing the modification of a rotation light filter.

Drawing 12 The composition explanatory view showing Embodiment 3 of the color picture generating device concerning this invention.

Drawing 13 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels of the electro-optic device in Embodiment 4 of the color picture generating device concerning this invention.

Drawing 14 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels of the electro-optic device in Embodiment 5 of the color picture generating device concerning this invention.

Drawing 15 The timing chart explaining operation of the timing circuit in Embodiment 5.

Drawing 16 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels of the electro-optic device in Embodiment 6 of the color picture generating device concerning this invention.

Drawing 17A timing chart for the circuit diagram showing a pixel circuit **in / in (A) / Embodiment 6** and (B) to explain operation of a pixel circuit.

Drawing 18 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels of the electro-optic device in Embodiment 7 of the color picture generating device concerning this invention.

Drawing 19 The circuit diagram showing the active-matrix-liquid-crystal display device drive circuit made to the substrate for panels in Embodiment 8 of the color picture generating device concerning this invention.

Drawing 20 The circuit diagram showing the digital store circuit in which (A) is provided

for every pixel of the active-matrix-liquid-crystal display device drive circuit in Embodiment 8, the timing chart (B) explains operation of a digital store circuit to be.
Drawing 21 The timing chart explaining overall operation of the active-matrix-liquid-crystal display device drive circuit in Embodiment 8.
Drawing 22 The circuit diagram showing the digital store circuit made to the substrate for panels of the electro-optic device in Embodiment 9 of the color picture generating device concerning this invention (substrate for electro-optic devices).
Drawing 23 The timing chart which shows colored light generation ****** using the pulse width modulation as which (A) is defined with Vertical Synchronizing signal VSYN, the timing chart (B) indicates the example of selection of the pulse width in the generation period of R light to be about red light among (A).
Drawing 24 The front view of the rotation light filter of the conventional color picture generating device.
Drawing 25 The timing chart of the conventional color picture generating device.
Drawing 26 The timing chart which shows the color picture generating timing of other conventional examples.
Explanations of letters or numerals
10, a 100 color-picture generating device
11 Light source
12 Rotation light filter
14 and 102 Electro-optic device
16 Screen
17 and 105 Microprocessor
18 and 106 Timing generator
19 and 107 Frame memory
20 and 108 Subframe conversion circuit
21 and 103 Drive circuit
23 The substrate for panels (substrate for electro-optic devices)
25 Opposite transparent base
26 Liquid crystal
27 Common electrode
28 Picture element electrode
50, 60, 70, 80, 85, 90 active-matrix-liquid-crystal display device drive circuit
51, 81, 91 active matrix circuits
52 Signal line driving circuit (X driver)
52a Pixel signal sampling circuit
52b Signal wire shift register (X shift register)
53 Scanning line driving circuit (Y driver)
53a Scanning line shift register (Y shift register)
53b Selection timing circuit
53b' write timing circuit
53ba Between opening read timing circuit
Y shift register for 53aa odd frames
Y shift register for even 53ab
55, 72, 82, 92 -- Pixel circuit
56, 83, a sample hold circuit
56a and 83a The 1st sample hold circuit
56b and 83b The 2nd sample hold circuit
57 and 84 Pixel driving circuit
101 Lighting system
109 Light source color switcher
A1, A2, an AND gate
N1 NOR gate
N2 NAND gate
INV Inverter
FF D type flip-flop
T1 and Q1 -- The 1st MOSFET

T2 and Q2 The 2nd MOSFET
T3 and Q3 The 3rd MOSFET
T4 and Q4 The 4th MOSFET
T5 and Q5 The 5th MOSFET
X, X1 - Xm signal electrode
Y Scanning electrode
Y1 and Y11-Yn1 The 1st scanning electrode
Y2 and Y12-Yn2 The 2nd scanning electrode
Y3 and Y13-Yn3 The 3rd scanning electrode
Y4 and Y14-Yn4 The 4th scanning electrode
phiH1 - phiHm switch drive timing pulse
phiV1 - phiVn line drive timing pulse
the **phi1** -- the write-in timing pulse of one
the **phi2** -- the write-in timing pulse of two
the **phi3** -- the read-out timing pulse of one
the **phi4** -- the read-out timing pulse of two
FR and FR' Liquid crystal AC converted signal
CLX, CLY, CLY1, and CLY2 Shift clock
DX Latch pulse
DY frame start pulse
V (O) odd number color subframe signal
V (E) even number color subframe signal

For drawings please refer to the original document.